General Foam

Valmont Industrial Park
West Hazleton, Pennsylvania 18201
(717) 455-4931

CONTAINS NO CBI

June 14, 1989

EPA-OTS
0006223660P
90-890000347

Document Processing Center
Office of Toxic Substances, TS-790
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460
Attn: CAIR Reporting Office

RE: Comprehensive Assessment Information Rule

Dear Sirs,

Enclosed is the CAIR Reporting Form for the General Foam facility, West Hazleton, PA. This form covers the listed Chemical toluene diisocyanate (C.A.S. 26471-62-5) as a process substance. Also enclosed with the form is a Material Safety Data Sheet for toluene diisocyanate and a report entitled "Fate of TDI and MDI in Air, Soil, and Water" from the Polyurethanes World Congress 1987.

If you have any questions, concerning the form, please do not hesitate to contact me.

Sincerely,

Robert J. Dervin
Supervisor, Waste Management

RD:tr

cc: D. Lichard
H. Stone
M. Fessler

CONTAINS NO CBI

EPA

Form Approved
OMB No. 2010-0019
Approval Expires 12-31-89

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Comprehensive Assessment Information Rule

REPORTING FORM

When completed, send this form to:	For Agency Use Only:
Document Processing Center Office of Toxic Substances, TS-790 U.S. Environmental Protection Agency 401 M Street, SW Washington, DC 20460 Attention: CAIR Reporting Office	Date of Receipt: ____________ Document Control Number: ____________ Docket Number: ____________

SECTION 1 GENERAL MANUFACTURER, IMPORTER, AND PROCESSOR INFORMATION

PART A GENERAL REPORTING INFORMATION

1.01 This Comprehensive Assessment Information Rule (CAIR) Reporting Form has been completed in response to the Federal Register Notice of..... [1][2] mo. [2][2] day [8][8] year

CBI

[_] a. If a Chemical Abstracts Service Number (CAS No.) is provided in the Federal Register, list the CAS No. .... [0][2][6][4][7][1]-[6][2]-[5]

b. If a chemical substance CAS No. is not provided in the Federal Register, list either (i) the chemical name, (ii) the mixture name, or (iii) the trade name of the chemical substance as provided in the Federal Register.

(i) Chemical name as listed in the rule ...... NA

(ii) Name of mixture as listed in the rule .... ____

(iii) Trade name as listed in the rule .... ____

c. If a chemical category is provided in the Federal Register, report the name of the category as listed in the rule, the chemical substance CAS No. you are reporting on which falls under the listed category, and the chemical name of the substance you are reporting on which falls under the listed category.

Name of category as listed in the rule .... NA

CAS No. of chemical substance .... [_][_][_][_][_][_]-[_][_]-[_]

Name of chemical substance .... ____

1.02 Identify your reporting status under CAIR by circling the appropriate response(s).

CBI

[_]

Manufacturer	1
Importer	2
Processor	3
X/P manufacturer reporting for customer who is a processor	4
X/P processor reporting for customer who is a processor	5

[_] Mark (X) this box if you attach a continuation sheet.

1.03 Does the substance you are reporting on have an "x/p" designation associated with it in the above-listed Federal Register Notice?

CBI

[ ]

Yes .... [x] Go to question 1.04

No .... [ ] Go to question 1.05

1.04 a. Do you manufacture, import, or process the listed substance and distribute it under a trade name(s) different than that listed in the Federal Register Notice? Circle the appropriate response.

CBI

[ ]

Yes 1

No 2

b. Check the appropriate box below: NA

[ ] You have chosen to notify your customers of their reporting obligations

Provide the trade name(s) .... ______________________

[ ] You have chosen to report for your customers

[ ] You have submitted the trade name(s) to EPA one day after the effective date of the rule in the Federal Register Notice under which you are reporting.

1.05 If you buy a trade name product and are reporting because you were notified of your reporting requirements by your trade name supplier, provide that trade name.

CBI

[ ]

Trade name .... Lupranate T80
Mondur TD, Voranate T-80, Rubinate TDI

Is the trade name product a mixture? Circle the appropriate response.

Yes 1

No ...(by E.P.A. definition)... 2

1.06 Certification -- The person who is responsible for the completion of this form must sign the certification statement below:

CBI

[ ]

"I hereby certify that, to the best of my knowledge and belief, all information entered on this form is complete and accurate."

David P. Lichard	David P Lichard	6-23-89
NAME	SIGNATURE	DATE SIGNED

Plant Manager	(717) 455 - 4931
TITLE	TELEPHONE NO.

[ ] Mark (X) this box if you attach a continuation sheet.

1.07 Exemptions From Reporting -- If you have provided EPA or another Federal agency with the required information on a CAIR Reporting Form for the listed substance within the past 3 years, and this information is current, accurate, and complete for the time period specified in the rule, then sign the certification below. You are required to complete section 1 of this CAIR form and provide any information now required but not previously submitted. Provide a copy of any previous submissions along with your Section 1 submission.

CBI

[_]

"I hereby certify that, to the best of my knowledge and belief, all required information which I have not included in this CAIR Reporting Form has been submitted to EPA within the past 3 years and is current, accurate, and complete for the time period specified in the rule."

NA

NAME	SIGNATURE	DATE SIGNED
TITLE	( ) - TELEPHONE NO.	DATE OF PREVIOUS SUBMISSION

1.08 CBI Certification -- If you have asserted any CBI claims in this report you must certify that the following statements truthfully and accurately apply to all of those confidentiality claims which you have asserted.

CBI

[_]

"My company has taken measures to protect the confidentiality of the information, and it will continue to take these measures; the information is not, and has not been, reasonably ascertainable by other persons (other than government bodies) by using legitimate means (other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding) without my company's consent; the information is not publicly available elsewhere; and disclosure of the information would cause substantial harm to my company's competitive position."

NA

NAME	SIGNATURE	DATE SIGNED
TITLE	( ) - TELEPHONE NO.	

[_] Mark (X) this box if you attach a continuation sheet.

PART B CORPORATE DATA

1.09 Facility Identification PMC

CBI

[_]

Name [G]E]N]E]R]A]L]_]F]O]A]M]_]_]_]_]_]_]_]_]_]_]_]_]_]

Address [2]5]_]J]A]Y]C]E]E]_]D]R]_]V]A]L]M]O]N]T]_]I]N]D]_]
Street

[W]E]S]T]_]H]A]Z]L]E]T]O]N]_]_]_]_]_]_]_]_]_]_]_]
City

[P]A] State [1]8]2]0]1]--[1]1]9]5] Zip

Dun & Bradstreet Number ....[0]7]-[9]4]3]-[1]8]3]9]

EPA ID Number ....[0]0]3]0]3]7]1]3]2]

Employer ID Number ....[9]5]3]0]5]4]4]4]2]

Primary Standard Industrial Classification (SIC) Code ....[3]0]8]6]

Other SIC Code ....[N]A]_]_]

Other SIC Code ....[N]A]_]_]

1.10 Company Headquarters Identification

CBI

[_]

Name [G]E]N]E]R]A]L]_]F]O]A]M]_]_]_]_]_]_]_]_]_]_]_]_]_]

Address [1]0]0]_]W]E]S]T]_]C]E]N]T]U]R]Y]_]R]O]A]D]_]_]_]_]
Street

[P]A]R]A]M]U]S]_]_]_]_]_]_]_]_]_]_]_]_]_]_]_]_]_]
City

[N]J] State [0]7]6]5]2]--[_]_]_]_] Zip

Dun & Bradstreet Number ....[1]7]-[3]7]6]-[0]7]7]8]

Employer ID Number ....[9]5]3]0]5]4]4]4]2]

[_] Mark (X) this box if you attach a continuation sheet.

1.11 Parent Company Identification

CBI Name [P][M][C][.][I][N][C][_]

[_] Address [P][O][_][B][O][X][_][1][3][6][7][_][_][_][_][_][_][_][_][_][_][_][_][_][_]
Street

[S][U][N][_][V][A][L][L][E][Y][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_]
City

[C][A] State [9][1][3][5][2]--[_][_][_][_] Zip

Dun & Bradstreet Number ....[0][7]-[6][1][9]-[1][5][1][9]

1.12 Technical Contact

CBI Name [D][R][_][H][E][R][M][A][N][_][S][T][O][N][E][_][_][_][_][_][_][_][_][_][_][_][_]

[_] Title [D][I][R][E][C][T][O][R][_][F][O][A][M][_][D][E][V][E][L][O][P][M][E][N][T][_]

Address [2][5][_][I][A][Y][C][E][E][_][D][R][_][_][_][_][_][_][_][_][_][_][_][_][_]
Street

[W][E][S][T][_][H][A][Z][L][E][T][O][N][_][_][_][_][_][_][_][_][_][_][_][_]
City

[P][A] State [1][8][2][0][1]--[1][1][9][5] Zip

Telephone Number ....[7][1][7]-[4][5][5]-[4][9][3][1]

1.13 This reporting year is from .... [0][1] Mo. [8][8] Year to [1][2] Mo. [8][8] Year

[_] Mark (X) this box if you attach a continuation sheet.

1.14 Facility Acquired -- If you purchased this facility during the reporting year, provide the following information about the seller:

CBI Name of Seller [N][A][_]

[_] Mailing Address [N][A][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_]
Street

[_]
City

[_][_] State [_][_][_][_][_]--[_][_][_][_] Zip

Employer ID Number ....[N][A][_][_][_][_][_][_]

Date of Sale ....[N][A] Mo. [_][_] Day [_][_] Year

Contact Person [N][A][_]

Telephone Number ....[_][_][_]-[_][_][_]-[_][_][_][_]

1.15 Facility Sold -- If you sold this facility during the reporting year, provide the following information about the buyer:

CBI Name of Buyer [N][A][_]

[_] Mailing Address [N][A][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_][_]
Street

[_]
City

[_][_] State [_][_][_][_][_]--[_][_][_][_] Zip

Employer ID Number ....[N][A][_][_][_][_][_][_]

Date of Purchase ....[_][_] Mo. [_][_] Day [_][_] Year

Contact Person [N][A][_]

Telephone Number ....[_][_][_]-[_][_][_]-[_][_][_][_]

[_] Mark (X) this box if you attach a continuation sheet.

1.16 For each classification listed below, state the quantity of the listed substance that was manufactured, imported, or processed at your facility during the reporting year.

CBI

[_]

Classification	Quantity (kg/yr)
Manufactured	NA
Imported	NA
Processed (include quantity repackaged)	5,896,000
Of that quantity manufactured or imported, report that quantity:	
In storage at the beginning of the reporting year	NA
For on-site use or processing	NA
For direct commercial distribution (including export)	NA
In storage at the end of the reporting year	NA
Of that quantity processed, report that quantity:	
In storage at the beginning of the reporting year	321,000
Processed as a reactant (chemical producer)	NA
Processed as a formulation component (mixture producer)	NA
Processed as an article component (article producer)	5,896,000
Repackaged (including export)	NA
In storage at the end of the reporting year	339,000

[_] Mark (X) this box if you attach a continuation sheet.

PART C IDENTIFICATION OF MIXTURES

1.17 Mixture -- If the listed substance on which you are required to report is a mixture or a component of a mixture, provide the following information for each component chemical. (If the mixture composition is variable, report an average percentage of each component chemical for all formulations.)

CBI

[_]

Component Name	Supplier Name	Average % Composition by Weight (specify precision, e.g., 45% ± 0.5%)
NA		
		Total 100%

[_] Mark (X) this box if you attach a continuation sheet.

2.04 State the quantity of the listed substance that your facility manufactured, imported, or processed during the 3 corporate fiscal years preceding the reporting year in descending order.

CBI

[ ] Year ending .... [1][2] Mo. [8][7] Year

Quantity manufactured .... NA kg

Quantity imported .... NA kg

Quantity processed .... 5,635,000 kg

Year ending .... [1][2] Mo. [8][6] Year

Quantity manufactured .... NA kg

Quantity imported .... NA kg

Quantity processed .... 5,394,000 kg

Year ending .... [1][2] Mo. [8][5] Year

Quantity manufactured .... NA kg

Quantity imported .... NA kg

Quantity processed .... 5,264,000 kg

2.05 Specify the manner in which you manufactured the listed substance. Circle all appropriate process types.

CBI

[ ]

Continuous process ..NA........................ 1

Semicontinuous process 2

Batch process 3

[ ] Mark (X) this box if you attach a continuation sheet.

2.06 Specify the manner in which you processed the listed substance. Circle all appropriate process types.
CBI

[ ]

Continuous process 1

Semicontinuous process 2

Batch process 3

2.07 State your facility's name-plate capacity for manufacturing or processing the listed substance. (If you are a batch manufacturer or batch processor, do not answer this question.)
CBI

[ ]

Manufacturing capacity .... NA kg/yr

Processing capacity .... UK kg/yr

---

2.08 If you intend to increase or decrease the quantity of the listed substance manufactured, imported, or processed at any time after your current corporate fiscal year, estimate the increase or decrease based upon the reporting year's production volume.
CBI

[ ]

	Manufacturing Quantity (kg)	Importing Quantity (kg)	Processing Quantity (kg)
Amount of increase	NA	NA	NA
Amount of decrease	NA	NA	NA

[ ] Mark (X) this box if you attach a continuation sheet.

2.09 For the three largest volume manufacturing or processing process types involving the listed substance, specify the number of days you manufactured or processed the listed substance during the reporting year. Also specify the average number of hours per day each process type was operated. (If only one or two operations are involved, list those.)

CBI

[ ]

		Days/Year	Average Hours/Day
Process Type #1 (The process type involving the largest quantity of the listed substance.)			
	Manufactured	NA	NA
	Processed	250	4
Process Type #2 (The process type involving the 2nd largest quantity of the listed substance.)			
	Manufactured	NA	NA
	Processed	NA	NA
Process Type #3 (The process type involving the 3rd largest quantity of the listed substance.)			
	Manufactured	NA	NA
	Processed	NA	NA

~~2.10~~ State the maximum daily inventory and average monthly inventory of the listed substance that was stored on-site during the reporting year in the form of a bulk chemical.

CBI

[ ]

Maximum daily inventory .... _______ kg

Average monthly inventory .... _______ kg

[ ] Mark (X) this box if you attach a continuation sheet.

2.11 Related Product Types -- List any byproducts, coproducts, or impurities present with the listed substance in concentrations greater than 0.1 percent as it is manufactured, imported, or processed. The source of byproducts, coproducts, or impurities means the source from which the byproducts, coproducts, or impurities are made or introduced into the product (e.g., carryover from raw material, reaction product, etc.).

CBI

[_]

~~CAS No.~~	Chemical Name	Byproduct, Coproduct or Impurity[1]	Concentration (%) (specify ± % precision)	Source of Byproducts, Coproducts, or Impurities
NA				

[1] Use the following codes to designate byproduct, coproduct, or impurity:

B = Byproduct
C = Coproduct
I = Impurity

[_] Mark (X) this box if you attach a continuation sheet.

2.12 Existing Product Types -- List all existing product types which you manufactured, imported, or processed using the listed substance during the reporting year. List the quantity of listed substance you use for each product type as a percentage of the total volume of listed substance used during the reporting year. Also list the quantity of listed substance used captively on-site as a percentage of the value listed under column b., and the types of end-users for each product type. (Refer to the instructions for further explanation and an example.)

CBI

[ ]

a. Product Types[1]	b. % of Quantity Manufactured, Imported, or Processed	c. % of Quantity Used Captively On-Site	d. Type of End-Users[2]
B	100	100	I

[1]Use the following codes to designate product types:

A = Solvent
B = Synthetic reactant
C = Catalyst/Initiator/Accelerator/Sensitizer
D = Inhibitor/Stabilizer/Scavenger/Antioxidant
E = Analytical reagent
F = Chelator/Coagulant/Sequestrant
G = Cleanser/Detergent/Degreaser
H = Lubricant/Friction modifier/Antiwear agent
I = Surfactant/Emulsifier
J = Flame retardant
K = Coating/Binder/Adhesive and additives
L = Moldable/Castable/Rubber and additives
M = Plasticizer
N = Dye/Pigment/Colorant/Ink and additives
O = Photographic/Reprographic chemical and additives
P = Electrodeposition/Plating chemicals
Q = Fuel and fuel additives
R = Explosive chemicals and additives
S = Fragrance/Flavor chemicals
T = Pollution control chemicals
U = Functional fluids and additives
V = Metal alloy and additives
W = Rheological modifier
X = Other (specify) ______

[2]Use the following codes to designate the type of end-users:

I = Industrial
CM = Commercial
CS = Consumer
H = Other (specify) ______

[ ] Mark (X) this box if you attach a continuation sheet.

2.13 Expected Product Types -- Identify all product types which you expect to manufacture, import, or process using the listed substance at any time after your current corporate fiscal year. For each use, specify the quantity you expect to manufacture, import, or process for each use as a percentage of the total volume of listed substance used during the reporting year. Also list the quantity of listed substance used captively on-site as a percentage of the value listed under column b., and the types of end-users for each product type. (Refer to the instructions for further explanation and an example.)

CBI

[_]

a.	b.	c.	d.
Product Types[1]	% of Quantity Manufactured, Imported, or Processed	% of Quantity Used Captively On-Site	Type of End-Users[2]
B	100	100	I

[1]Use the following codes to designate product types:

A = Solvent
B = Synthetic reactant
C = Catalyst/Initiator/Accelerator/Sensitizer
D = Inhibitor/Stabilizer/Scavenger/Antioxidant
E = Analytical reagent
F = Chelator/Coagulant/Sequestrant
G = Cleanser/Detergent/Degreaser
H = Lubricant/Friction modifier/Antiwear agent
I = Surfactant/Emulsifier
J = Flame retardant
K = Coating/Binder/Adhesive and additives
L = Moldable/Castable/Rubber and additives
M = Plasticizer
N = Dye/Pigment/Colorant/Ink and additives
O = Photographic/Reprographic chemical and additives
P = Electrodeposition/Plating chemicals
Q = Fuel and fuel additives
R = Explosive chemicals and additives
S = Fragrance/Flavor chemicals
T = Pollution control chemicals
U = Functional fluids and additives
V = Metal alloy and additives
W = Rheological modifier
X = Other (specify) __________

[2]Use the following codes to designate the type of end-users:

I = Industrial
CM = Commercial
CS = Consumer
H = Other (specify) __________

[_] Mark (X) this box if you attach a continuation sheet.

2.14 Final Product -- Complete the following table for each type of final product manufactured, imported, or processed at your facility that contains the listed substance other than as an impurity.

CBI

[ ]

a. Product Type[1]	b. Final Product's Physical Form[2]	c. Average % Composition of Listed Substance in Final Product	d. Type of End-Users[3]
NA			

[1]Use the following codes to designate product types:

A = Solvent
B = Synthetic reactant
C = Catalyst/Initiator/Accelerator/Sensitizer
D = Inhibitor/Stabilizer/Scavenger/Antioxidant
E = Analytical reagent
F = Chelator/Coagulant/Sequestrant
G = Cleanser/Detergent/Degreaser
H = Lubricant/Friction modifier/Antiwear agent
I = Surfactant/Emulsifier
J = Flame retardant
K = Coating/Binder/Adhesive and additives
L = Moldable/Castable/Rubber and additives
M = Plasticizer
N = Dye/Pigment/Colorant/Ink and additives
O = Photographic/Reprographic chemical and additives
P = Electrodeposition/Plating chemicals
Q = Fuel and fuel additives
R = Explosive chemicals and additives
S = Fragrance/Flavor chemicals
T = Pollution control chemicals
U = Functional fluids and additives
V = Metal alloy and additives
W = Rheological modifier
X = Other (specify) ____________

[2]Use the following codes to designate the final product's physical form:

A = Gas
B = Liquid
C = Aqueous solution
D = Paste
E = Slurry
F1 = Powder
F2 = Crystalline solid
F3 = Granules
F4 = Other solid
G = Gel
H = Other (specify) ____________

[3]Use the following codes to designate the type of end-users:

I = Industrial
CM = Commercial
CS = Consumer
H = Other (specify) ____________

[ ] Mark (X) this box if you attach a continuation sheet.

2.15 Circle all applicable modes of transportation used to deliver bulk shipments of the listed substance to off-site customers.

CBI

[_] Truck 1

Railcar 2

Barge, Vessel 3

Pipeline 4

Plane 5

Other (specify) NA 6

2.16 Customer Use -- Estimate the quantity of the listed substance used by your customers or prepared by your customers during the reporting year for use under each category of end use listed (i-iv).

CBI

[_]

Category of End Use

i. Industrial Products

Chemical or mixture .... NA kg/yr

Article .... NA kg/yr

ii. Commercial Products

Chemical or mixture .... NA kg/yr

Article .... NA kg/yr

iii. Consumer Products

Chemical or mixture .... NA kg/yr

Article .... NA kg/yr

iv. Other

Distribution (excluding export) .... NA kg/yr

Export .... NA kg/yr

Quantity of substance consumed as reactant .... NA kg/yr

Unknown customer uses .... NA kg/yr

---

[_] Mark (X) this box if you attach a continuation sheet.

SECTION 3 PROCESSOR RAW MATERIAL IDENTIFICATION

PART A GENERAL DATA

3.01 Specify the quantity purchased and the average price paid for the listed substance for each major source of supply listed. Product trades are treated as purchases.

CBI The average price is the market value of the product that was traded for the listed substance.

[ ]

Source of Supply	Quantity (kg)	Average Price ($/kg)
The listed substance was manufactured on-site.	NA	NA
The listed substance was transferred from a different company site.	NA	NA
The listed substance was purchased directly from a manufacturer or importer.	5,914,000	$2.00
The listed substance was purchased from a distributor or repackager.	NA	NA
The listed substance was purchased from a mixture producer.	NA	NA

3.02 Circle all applicable modes of transportation used to deliver the listed substance to

CBI your facility.

[ ]

Truck 1

Railcar 2

Barge, Vessel 3

Pipeline 4

Plane 5

Other (specify) ________________ 6

[ ] Mark (X) this box if you attach a continuation sheet.

3.03 a. Circle all applicable containers used to transport the listed substance to your facility.

CBI

[ ]

Bags 1

Boxes 2

Free standing tank cylinders 3

Tank rail cars 4

Hopper cars 5

Tank trucks 6

Hopper trucks 7

Drums 8

Pipeline 9

Other (specify) ______ 10

b. If the listed substance is transported in pressurized tank cylinders, tank rail cars, or tank trucks, state the pressure of the tanks.

Tank cylinders .... NA mmHg

Tank rail cars .... 760-7600 mmHg

Tank trucks .... 760-7600 mmHg

[ ] Mark (X) this box if you attach a continuation sheet.

PART B RAW MATERIAL IN THE FORM OF A MIXTURE

3.04 If you obtain the listed substance in the form of a mixture, list the trade name(s) of the mixture, the name of its supplier(s) or manufacturer(s), an estimate of the average percent composition by weight of the listed substance in the mixture, and the amount of mixture processed during the reporting year.

CBI

[_]

Trade Name	Supplier or Manufacturer	Average % Composition by Weight (specify ± % precision)	Amount Processed (kg/yr)
NA			

[_] Mark (X) this box if you attach a continuation sheet.

PART C RAW MATERIAL VOLUME

3.05 CBI [_] State the quantity of the listed substance used as a raw material during the reporting year in the form of a class I chemical, class II chemical, or polymer, and the percent composition, by weight, of the listed substance.

	Quantity Used (kg/yr)	% Composition by Weight of Listed Substance in Raw Material (specify ± % precision)
Class I chemical	5,896,000	99.9%
Class II chemical	NA	NA
Polymer	NA	NA

[_] Mark (X) this box if you attach a continuation sheet.

SECTION 4 PHYSICAL/CHEMICAL PROPERTIES

General Instructions:

If you are reporting on a mixture as defined in the glossary, reply to questions in Section 4 that are inappropriate to mixtures by stating "NA -- mixture."

For questions 4.06-4.15, if you possess any hazard warning statement, label, MSDS, or other notice that addresses the information requested, you may submit a copy or reasonable facsimile in lieu of answering those questions which it addresses.

PART A PHYSICAL/CHEMICAL DATA SUMMARY

4.01 Specify the percent purity for the three major[1] technical grade(s) of the listed substance as it is manufactured, imported, or processed. Measure the purity of the substance in the final product form for manufacturing activities, at the time you import the substance, or at the point you begin to process the substance.

CBI

[ ]

	Manufacture	Import	Process
Technical grade #1	NA % purity	NA % purity	99.9 % purity
Technical grade #2	NA % purity	NA % purity	NA % purity
Technical grade #3	NA % purity	NA % purity	NA % purity

[1]Major = Greatest quantity of listed substance manufactured, imported or processed.

4.02 Submit your most recently updated Material Safety Data Sheet (MSDS) for the listed substance, and for every formulation containing the listed substance. If you possess an MSDS that you developed and an MSDS developed by a different source, submit your version. Indicate whether at least one MSDS has been submitted by circling the appropriate response.

Yes 1

No 2

Indicate whether the MSDS was developed by your company or by a different source.

Your company 1

Another source 2

[ ] Mark (X) this box if you attach a continuation sheet.

4.03 Submit a copy or reasonable facsimile of any hazard information (other than an MSDS) that is provided to your customers/users regarding the listed substance or any formulation containing the listed substance. Indicate whether this information has been submitted by circling the appropriate response.

Yes 1

No 2

4.04 For each activity that uses the listed substance, circle all the applicable number(s) corresponding to each physical state of the listed substance during the activity listed. Physical states for importing and processing activities are determined at the time you import or begin to process the listed substance. Physical states for manufacturing, storage, disposal and transport activities are determined using the final state of the product.

CBI

[_]

	Physical State				
Activity	Solid	Slurry	Liquid	Liquified Gas	Gas
Manufacture	1	2	3	4	5
Import	1	2	3	4	5
Process	1	2	3	4	5
Store	1	2	3	4	5
Dispose	1	2	3	4	5
Transport	1	2	3	4	5

[_] Mark (X) this box if you attach a continuation sheet.

4.05 Particle Size -- If the listed substance exists in particulate form during any of the following activities, indicate for each applicable physical state the size and the percentage distribution of the listed substance by activity. Do not include particles ≥10 microns in diameter. Measure the physical state and particle sizes for importing and processing activities at the time you import or begin to process the listed substance. Measure the physical state and particle sizes for manufacturing storage, disposal and transport activities using the final state of the product.

CBI

[ ]

Physical State		Manufacture	Import	Process	Store	Dispose	Transport
Dust	<1 micron	NA	NA	NA	NA	NA	NA
	1 to <5 microns	NA	NA	NA	NA	NA	NA
	5 to <10 microns	NA	NA	NA	NA	NA	NA
Powder	<1 micron	NA	NA	NA	NA	NA	NA
	1 to <5 microns	NA	NA	NA	NA	NA	NA
	5 to <10 microns	NA	NA	NA	NA	NA	NA
Fiber	<1 micron	NA	NA	NA	NA	NA	NA
	1 to <5 microns	NA	NA	NA	NA	NA	NA
	5 to <10 microns	NA	NA	NA	NA	NA	NA
Aerosol	<1 micron	NA	NA	NA	NA	NA	NA
	1 to <5 microns	NA	NA	NA	NA	NA	NA
	5 to <10 microns	NA	NA	NA	NA	NA	NA

[ ] Mark (X) this box if you attach a continuation sheet.

SECTION 5 ENVIRONMENTAL FATE

PART A RATE CONSTANTS AND TRANSFORMATION PRODUCTS

5.01 Indicate the rate constants for the following transformation processes.

a. Photolysis:

Absorption spectrum coefficient (peak) .... UK (1/M cm) at ______ nm

Reaction quantum yield, ϕ .... UK at ______ nm

Direct photolysis rate constant, k_p, at ... UK 1/hr ______ latitude

b. Oxidation constants at 25°C:

For $^1O_2$ (singlet oxygen), k_{ox} .... UK 1/M hr

For RO_2 (peroxy radical), k_{ox} .... UK 1/M hr

c. Five-day biochemical oxygen demand, BOD_5 ... UK mg/l

d. Biotransformation rate constant:

For bacterial transformation in water, k_b... UK 1/hr

Specify culture .... UK

e. Hydrolysis rate constants:

For base-promoted process, k_B .... UK 1/M hr

For acid-promoted process, k_A .... UK 1/M hr

For neutral process, k_N .... UK 1/hr

f. Chemical reduction rate (specify conditions) UK

g. Other (such as spontaneous degradation) ... UK

[ ] Mark (X) this box if you attach a continuation sheet.

PART B PARTITION COEFFICIENTS

5.02 a. Specify the half-life of the listed substance in the following media.

Media	Half-life (specify units)
Groundwater	~~Solidifies on contact: forms non-toxic polyurea~~
Atmosphere	3 hours
Surface water	~~Solidifies on contact: forms non-toxic polyurea~~
Soil	~~Solidifies on contact: forms non-toxic polyurea~~

* See attached information

b. Identify the listed substance's known transformation products that have a half-life greater than 24 hours.

CAS No.	Name	Half-life (specify units)		Media
UK			in	
			in	
			in	
			in	

5.03 Specify the octanol-water partition coefficient, K_{ow} ... UK at 25°C

Method of calculation or determination .... ________

5.04 Specify the soil-water partition coefficient, K_d .... UK at 25°C

Soil type .... ________

5.05 Specify the organic carbon-water partition coefficient, K_{oc} .... UK at 25°C

5.06 Specify the Henry's Law Constant, H .... UK atm-m^3/mole

[ ] Mark (X) this box if you attach a continuation sheet.

5.07 List the bioconcentration factor (BCF) of the listed substance, the species for which it was determined, and the type of test used in deriving the BCF.

Bioconcentration Factor	Species	Test[1]
UK		

[1]Use the following codes to designate the type of test:

F = Flowthrough
S = Static

[ ] Mark (X) this box if you attach a continuation sheet.

~~6.04~~ For each market listed below, state the quantity sold and the total sales value of the listed substance sold or transferred in bulk during the reporting year.

CBI

[_]

Market	Quantity Sold or Transferred (kg/yr)	Total Sales Value ($/yr)
Retail sales		
Distribution -- Wholesalers		
Distribution -- Retailers		
Intra-company transfer		
Repackagers		
Mixture producers		
Article producers		
Other chemical manufacturers or processors		
Exporters		
Other (specify)		

6.05 Substitutes -- List all known commercially feasible substitutes that you know exist for the listed substance and state the cost of each substitute. A commercially feasible substitute is one which is economically and technologically feasible to use in your current operation, and which results in a final product with comparable performance in its end uses.

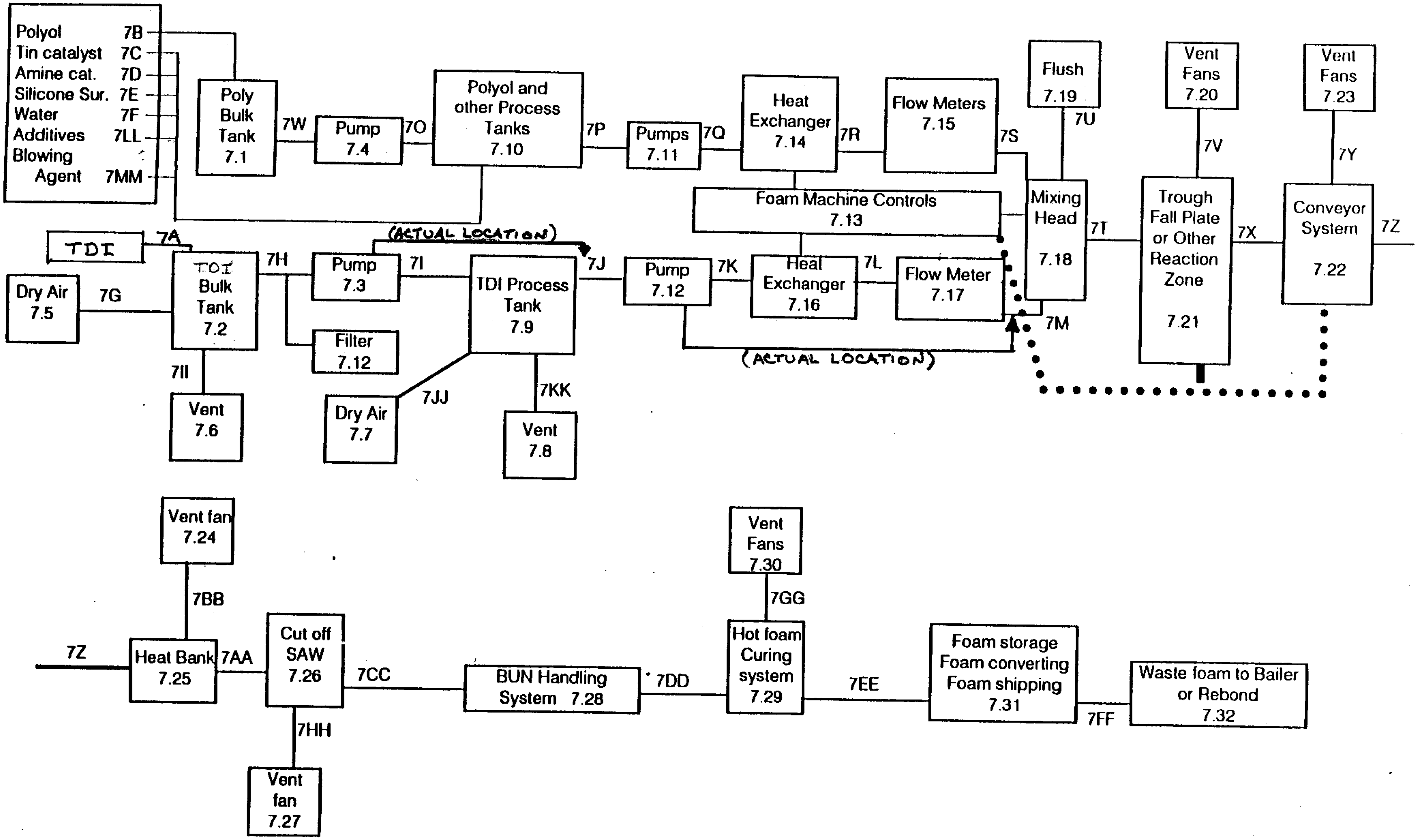
CBI

[_]

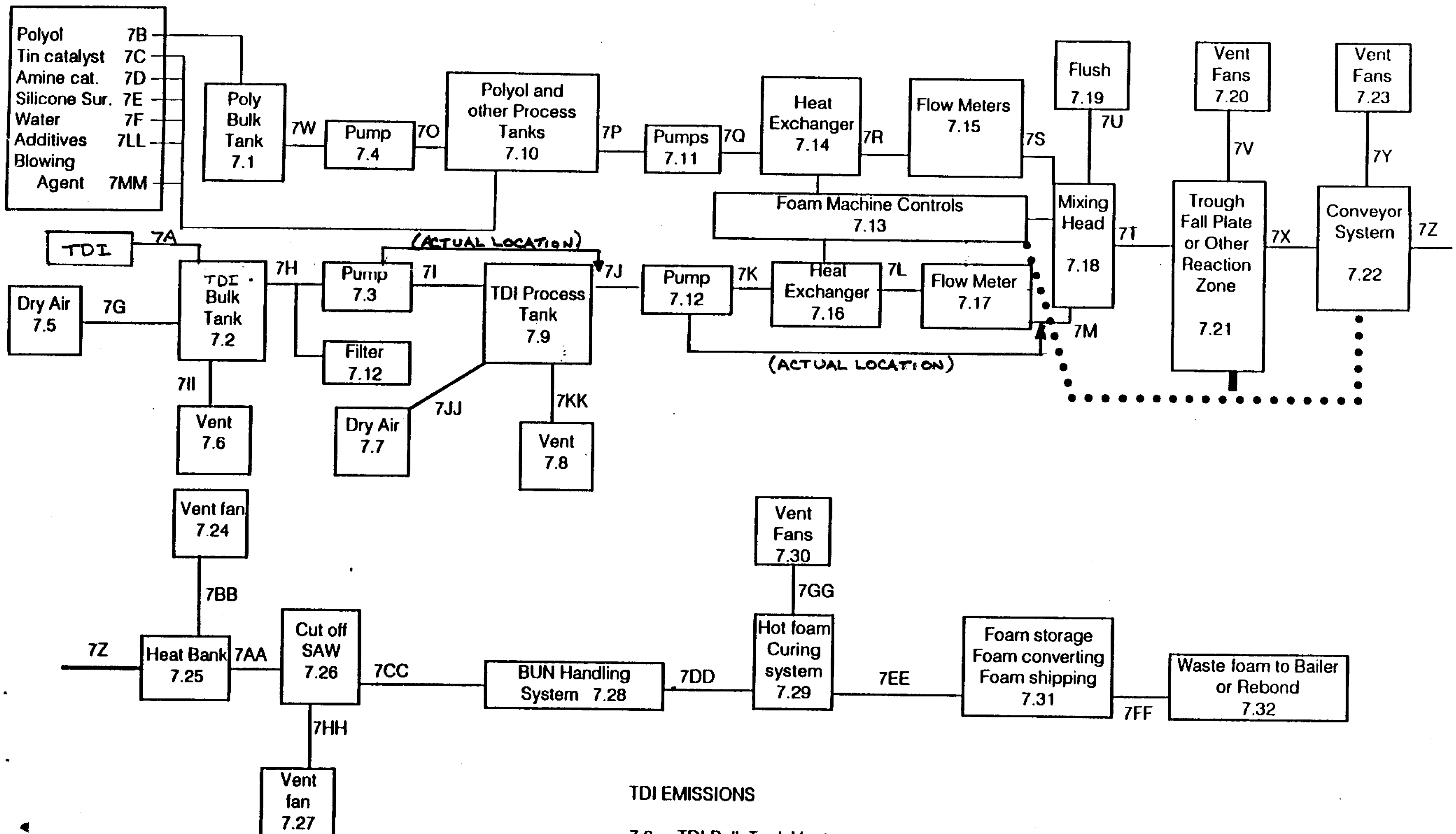
Substitute	Cost ($/kg)
UK	

[_] Mark (X) this box if you attach a continuation sheet.

7.01 PROCESSOR
Process Type: Flexible Slabstock Polyurethane Foam Manufacturing Process
Intermediates: None



7.03 EMISSIONS
Process Type: Flexible Slabstock Polyurethane Foam Manufacturing Process
Intermediates: None



TDI EMISSIONS

7.6 TDI Bulk Tank Vent
7.8 Process Tank Vent
7.3, 7.12 TDI Pump Seals
7.20 Reaction Zone Vent Fans
7.23 Conveyor System Vent Fans
7.24 Heat Bank Vent Fan
7.27 Cut Off Saw Vent Fan
7.30 Curing Area Vent Fans
7.33 TDI Filter

7.04 Describe the typical equipment types for each unit operation identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type.

CBI

[_] Process type .... Flexible Polyurethane Foam, Manu. Process

Unit Operation ID Number	Typical Equipment Type	Operating Temperature Range (°C)	Operating Pressure Range (mm Hg)	Vessel Composition
7.1	Bulk Storage Tanks	Ambient	Atmospheric	Steel
7.2	TDI Bulk Storage Tanks	26°C	Atmospheric	Steel
7.3	Self-Encapsulated Gear Pumps	Ambient	760-2070mmHg	Steel
7.4	Gear Pumps	Ambient	760-5700mmHg	Steel
7.6	Storage Tank Vents	Ambient	Atmospheric	Steel
7.8	TDI Process Tank Vents	Ambient	Atmospheric	Steel
7.9	TDI Process Tanks	26°C	760-2600mmHg	Steel
7.10	Chemical Process Tanks	43°C	760-3620mmHg	Steel
7.11	Gear Pumps	43°C	760-18100mmHg	Steel
7.12	Gear Pumps	26°C	760-93100mmHg	Steel

[X] Mark (X) this box if you attach a continuation sheet.

7.04 Describe the typical equipment types for each unit operation identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type.

CBI

[ ] Process type .... Flexible Polyurethane Foam, Manu. Process

Unit Operation ID Number	Typical Equipment Type	Operating Temperature Range (°C)	Operating Pressure Range (mm Hg)	Vessel Composition
7.13	Computerized Foam Machine Controls	Ambient	Atmospheric	Steel
7.14	Heat Exchanger	20°C-43°C	760-5700mmHg	Steel
7.15	Flow Meters	20°C-27°C	760-9300mmHg	Steel/Glass
7.16	Heat Exchanger	20°C-43°C	760-5700mmHg	Steel
7.17	Flow Meters	20°C-27°C	760-9300mmHg	Steel/Glass
7.18	Central Mixing Head	20°C-43°C	760-1810mmHg	Steel
7.20	Process Vents	Ambient	Atmospheric	Steel/Canvas
7.21	Trough and/or Reaction Zone	20°C-43°C	Atmospheric	Steel
7.22	Process Conveyor System	Ambient	Atmospheric	Steel
7.23	Process Vents	Ambient	Atmospheric	Steel/Plastic

[X] Mark (X) this box if you attach a continuation sheet.

7.04 Describe the typical equipment types for each unit operation identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Unit Operation ID Number	Typical Equipment Type	Operating Temperature Range (°C)	Operating Pressure Range (mm Hg)	Vessel Composition
7.25	Infra-Red Heating Banks	93°C	Atmospheric	Steel
7.26	Traveling Cut See Saw	Ambient	Atmospheric	Steel
7.27	Exhaust Fan	Ambient	Atmospheric	Steel
7.28	Traveling Conveyor System	Ambient	Atmospheric	Steel
7.29	Hot Foam Curing Racks	Ambient	Atmospheric	Steel
7.30	Curing Area Exhaust Vents	Ambient	Atmospheric	Steel

[ ] Mark (X) this box if you attach a continuation sheet.

7.05 Describe each process stream identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Process Stream ID Code	Process Stream Description	Physical State[1]	Stream Flow (kg/yr)
7H,7I,7J,7K 7L,7M,7A	Toluene Diisocyanate	OL	5,896,000
7W,7O,7P,7Q, 7R,7S	Polyol Resins	OL	11,512,000
7P,7Q,7R, 7S	Water	AL	461,000
7P,7Q,7R,7S	Tin Catalyst	OL	27,000
7P,7Q,7R,7S	Amine Catalyst	OL	40,000
7P,7Q,7R,7S,	Silicone Surfactant	OL	164,000
7P,7Q,7R,7S	Organic Pigments	OL	152,000
7P,7Q,7R,7S	Blowing Agents	OL	406,000

[1] Use the following codes to designate the physical state for each process stream:

GC = Gas (condensible at ambient temperature and pressure)
GU = Gas (uncondensible at ambient temperature and pressure)
SO = Solid
SY = Sludge or slurry
AL = Aqueous liquid
OL = Organic liquid
IL = Immiscible liquid (specify phases, e.g., 90% water, 10% toluene)

[X] Mark (X) this box if you attach a continuation sheet.

7.05 Describe each process stream identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Process Stream ID Code	Process Stream Description	Physical State[1]	Stream Flow (kg/yr)
7P,7Q,7R,7S	Flame Retardants	OL	694,000
7P,7Q,7R,7S	Miscellaneous Fillers	SO	391,000
7P,7Q,7R,7S	Miscellaneous Additives	OL	153,000
7G,7JJ	Dry Air	GC	UK
7X,7Z,7AA,7FF 7CC,7DD,7T,7EE	Polyurethane Foam	SO	18,775,000
7U	Mixing Head Flush	OL	UK

[1]Use the following codes to designate the physical state for each process stream:

GC = Gas (condensible at ambient temperature and pressure)
GU = Gas (uncondensible at ambient temperature and pressure)
SO = Solid
SY = Sludge or slurry
AL = Aqueous liquid
OL = Organic liquid
IL = Immiscible liquid (specify phases, e.g., 90% water, 10% toluene)

[ ] Mark (X) this box if you attach a continuation sheet.

7.06 Characterize each process stream identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type. (Refer to the instructions for further explanation and an example.)

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

a. Process Stream ID Code	b. Known Compounds[1]	c. Concentrations[2,3] (% or ppm)	d. Other Expected Compounds	e. Estimated Concentrations (% or ppm)
7H,7I,7J 7K,7L,7M	Toluene Diisocyanate	100%(A)(W)	NA	NA
7W,70,7P 7Q,7R,7S	Polyol, Water, Amine,			
	Tin, Silicone Surfactant,	100% (A)(W)	NA	NA
	Pigments, Blowing Agents			
	Misc. Misc. Fillers,Additives			
7T	TDI,Polyol, Water,			
	Amine, Tin, Silicone	100%(A)(W)	NA	NA
	Pigments, Blowing Agents			
	Misc. Misc.Fillers,Additives			

7.06 continued below

[X] Mark (X) this box if you attach a continuation sheet.

7.06 Characterize each process stream identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type. (Refer to the instructions for further explanation and an example.)

CBI

[ ] Process type .... Flexible Polyurethane Manu. Process

a. Process Stream ID Code	b. Known Compounds[1]	c. Concentrations[2,3] (% or ppm)	d. Other Expected Compounds	e. Estimated Concentrations (% or ppm)
7X,7Z,7AA, 7CC,7DD,7EE 7FF	Polyurethane Foam	100%(A)(W)	NA	NA
7II,7KK	TDI	0.03ppm(A)(V)	NA	NA
	Air	99.9%(E)(V)	NA	NA
7V,7Y,7BB	TDI	0.125ppm(A)(V)	Blowing Agents	0.0-1.5%
	Air	98.0-99.5%(E)(V)	Carbon Dioxide	0.5-1.0%

7.06 continued below

[X] Mark (X) this box if you attach a continuation sheet.

7.06 Characterize each process stream identified in your process block flow diagram(s). If a process block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type. (Refer to the instructions for further explanation and an example.)

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

a. Process Stream ID Code	b. Known Compounds[1]	c. Concentrations[2,3] (% or ppm)	d. Other Expected Compounds	e. Estimated Concentrations (% or ppm)
7HH	TDI	0.009ppm(A)(V)	NA	NA
	Air	99.9%(E)(V)	NA	NA
7GG	TDI	0.035ppm(A)(W)	NA	NA
	Air	99.9%(E)(W)	NA	NA

7.06 continued below

[ ] Mark (X) this box if you attach a continuation sheet.

7.06 (continued)

[1]For each additive package introduced into a process stream, specify the compounds that are present in each additive package, and the concentration of each component. Assign an additive package number to each additive package and list this number in column b. (Refer to the instructions for further explanation and an example. Refer to the glossary for the definition of additive package.)

Additive Package Number	Components of Additive Package	Concentrations (% or ppm)
1	NA	
2		
3		
4		
5		

[2]Use the following codes to designate how the concentration was determined:

A = Analytical result
E = Engineering judgement/calculation

[3]Use the following codes to designate how the concentration was measured:

V = Volume
W = Weight

[ ] Mark (X) this box if you attach a continuation sheet.

PART A RESIDUAL TREATMENT PROCESS DESCRIPTION

8.01 In accordance with the instructions, provide a residual treatment block flow diagram which describes the treatment process used for residuals identified in question 7.01.

CBI

[ ] Process type .... NA

[ ] Mark (X) this box if you attach a continuation sheet.

PART B RESIDUAL GENERATION AND CHARACTERIZATION

8.05 Characterize each process stream identified in your residual treatment block flow diagram(s). If a residual treatment block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type. (Refer to the instructions for further explanation and an example.)

CBI

[ ] Process type .... NA

a. Stream ID Code	b. Type of Hazardous Waste[1]	c. Physical State of Residual[2]	d. Known Compounds[3]	e. Concentrations (% or ppm)[4,5,6]	f. Other Expected Compounds	g. Estimated Concentrations (% or ppm)
		NA				

8.05 continued below

[ ] Mark (X) this box if you attach a continuation sheet.

8.05 (continued)

[1]Use the following codes to designate the type of hazardous waste:

I = Ignitable
C = Corrosive
R = Reactive
E = EP toxic
T = Toxic
H = Acutely hazardous

[2]Use the following codes to designate the physical state of the residual:

GC = Gas (condensible at ambient temperature and pressure)
GU = Gas (uncondensible at ambient temperature and pressure)
SO = Solid
SY = Sludge or slurry
AL = Aqueous liquid
OL = Organic liquid
IL = Immiscible liquid (specify phases, e.g., 90% water, 10% toluene)

8.05 continued below

[ ] Mark (X) this box if you attach a continuation sheet.

8.05 (continued)

[3]For each additive package introduced into a process stream, specify the compounds that are present in each additive package, and the concentration of each component. Assign an additive package number to each additive package and list this number in column d. (Refer to the instructions for further explanation and an example. Refer to the glossary for the definition of additive package.)

Additive Package Number	Components of Additive Package	Concentrations (% or ppm)
1	NA	
2		
3		
4		
5		

[4]Use the following codes to designate how the concentration was determined:

A = Analytical result
E = Engineering judgement/calculation

8.05 continued below

[ ] Mark (X) this box if you attach a continuation sheet.

8.05 (continued)

[5]Use the following codes to designate how the concentration was measured:

V = Volume
W = Weight

[6]Specify the analytical test methods used and their detection limits in the table below. Assign a code to each test method used and list those codes in column e.

Code	Method	Detection Limit (± ug/l)
1	NA	
2		
3		
4		
5		
6		

[ ] Mark (X) this box if you attach a continuation sheet.

8.06 Characterize each process stream identified in your residual treatment block flow diagram(s). If a residual treatment block flow diagram is provided for more than one process type, photocopy this question and complete it separately for each process type. (Refer to the instructions for further explanation and an example.)

CBI

[ ] Process type .... NA

a. Stream ID Code	b. Waste Description Code[1]	c. Management Method Code[2]	d. Residual Quantities (kg/yr)	e. Management of Residual (%) On-Site	Off-Site	f. Costs for Off-Site Management (per kg)	g. Changes in Management Methods
NA							

[1]Use the codes provided in Exhibit 8-1 to designate the waste descriptions

[2]Use the codes provided in Exhibit 8-2 to designate the management methods

[ ] Mark (X) this box if you attach a continuation sheet.

8.22 Describe the combustion chamber design parameters for each of the three largest (by capacity) incinerators that are used on-site to burn the residuals identified in
CBI your process block or residual treatment block flow diagram(s).

[_]

	Combustion Chamber Temperature (°C)		Location of Temperature Monitor		Residence Time In Combustion Chamber (seconds)	
Incinerator	Primary	Secondary	Primary	Secondary	Primary	Secondary
1	NA					
2						
3						

Indicate if Office of Solid Waste survey has been submitted in lieu of response by circling the appropriate response.

Yes 1

No 2

8.23 Complete the following table for the three largest (by capacity) incinerators that are used on-site to burn the residuals identified in your process block or residual
CBI treatment block flow diagram(s).

[_]

Incinerator	Air Pollution Control Device[1]	Types of Emissions Data Available
1	NA	NA
2		
3		

Indicate if Office of Solid Waste survey has been submitted in lieu of response by circling the appropriate response.

Yes 1

No 2

[1]Use the following codes to designate the air pollution control device:

S = Scrubber (include type of scrubber in parenthesis)
E = Electrostatic precipitator
O = Other (specify) ________________

[_] Mark (X) this box if you attach a continuation sheet.

PART A EMPLOYMENT AND POTENTIAL EXPOSURE PROFILE

9.01 Mark (X) the appropriate column to indicate whether your company maintains records on the following data elements for hourly and salaried workers. Specify for each data element the year in which you began maintaining records and the number of years the records for that data element are maintained. (Refer to the instructions for further explanation and an example.)

CBI

[_]

Data Element	Data are Maintained for: Hourly Workers	Salaried Workers	Year in Which Data Collection Began	Number of Years Records Are Maintained
Date of hire	X	X	1981	(25)
Age at hire	X	X	1981	25
Work history of individual before employment at your facility	X	X	1981	25
Sex	X	X	1981	25
Race	X	X	1981	25
Job titles	X	X	1981	25
Start date for each job title	X	X	1981	25
End date for each job title	X	X	1981	25
Work area industrial hygiene monitoring data	X	X	1981	25
Personal employee monitoring data	NA	NA	NA	NA
Employee medical history	X	X	1981	25
Employee smoking history	X	X	1981	25
Accident history	X	X	1981	25
Retirement date	X	X	1981	25
Termination date	X	X	1981	25
Vital status of retirees	NA	NA	NA	NA
Cause of death data	NA	NA	NA	NA

[_] Mark (X) this box if you attach a continuation sheet.

9.02 In accordance with the instructions, complete the following table for each activity in which you engage.

CBI

[ ]

a. Activity	b. Process Category	c. Yearly Quantity (kg)	d. Total Workers	e. Total Worker-Hours
Manufacture of the listed substance	Enclosed	NA	NA	NA
	Controlled Release	NA	NA	NA
	Open	NA	NA	NA
On-site use as reactant	Enclosed	NA	NA	NA
	Controlled Release	5,896,000	33	33,000*
	Open	NA	NA	NA
On-site use as nonreactant	Enclosed	NA	NA	NA
	Controlled Release	NA	NA	NA
	Open	NA	NA	NA
On-site preparation of products	Enclosed	NA	NA	NA
	Controlled Release	NA	NA	NA
	Open	NA	NA	NA

* Total Worker-Hours is Based on Potential Exposure for 4 Hours/Day

[ ] Mark (X) this box if you attach a continuation sheet.

9.03 Provide a descriptive job title for each labor category at your facility that encompasses workers who may potentially come in contact with or be exposed to the listed substance.

CBI

[_]

Labor Category	Descriptive Job Title
A	Foam Machine Supervisor
B	Foam Machine Head Foreman
C	~~Foam Machine Floor Foreman~~
D	Foam Machine Operator
E	Foam Machine Assistant
F	Compounder
G	~~Cut-Off Saw Operator~~
H	Band Saw
I	Utility Man
J	Baler Operator
K	Hi-Lo Operator
L	Rack Selector
M	Shuttle Controller
N	Material Expediters
O	Maintenance

[_] Mark (X) this box if you attach a continuation sheet.

9.05 Describe the various work area(s) shown in question 9.04 that encompass workers who may potentially come in contact with or be exposed to the listed substance. Add any additional areas not shown in the process block flow diagram in question 7.01 or 7.02. Photocopy this question and complete it separately for each process type.

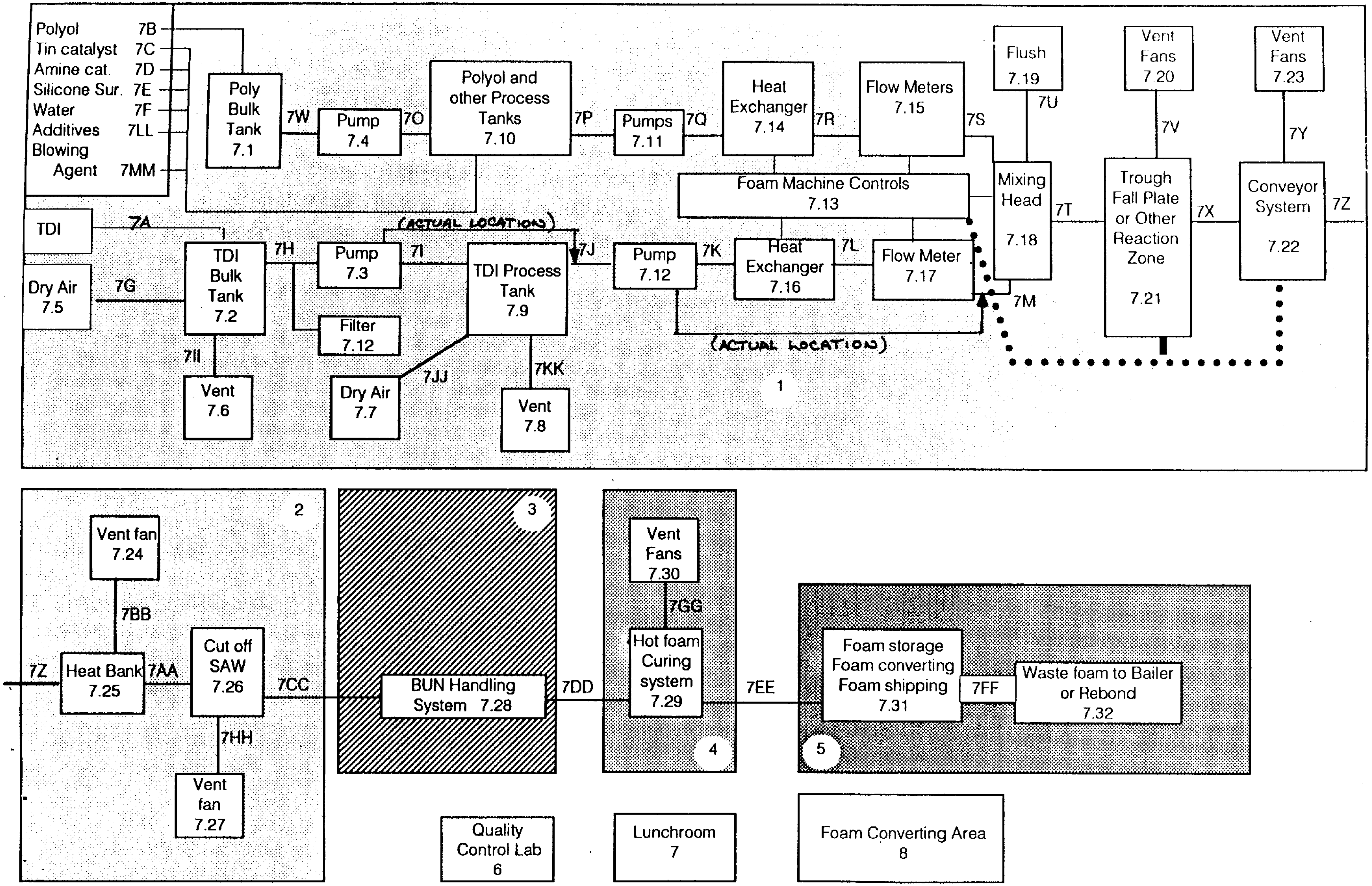
CBI

[ ] Process type .... Flexible Polyurethane Manu. Process

Work Area ID	Description of Work Areas and Worker Activities
1	Enclosed Conveyor System ~~Storage Tank Areas, Pumping Systems, Foam Machine Controls~~
2	Traveling Cut-Off Saws, Infra-Red Heat Banks
3	Moving Conveyor System
4	Hot Foam Curing Racks
5	
6	
7	
8	
9	
10	

[ ] Mark (X) this box if you attach a continuation sheet.

9.04
Process Type: Flexible Slabstock Polyurethane Foam Manufacturing Process
Intermediates: None



9.06 Complete the following table for each work area identified in question 9.05, and for each labor category at your facility that encompasses workers who may potentially come in contact with or be exposed to the listed substance. Photocopy this question

CBI and complete it separately for each process type and work area.

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 1

Labor Category	Number of Workers Exposed	Mode of Exposure (e.g., direct skin contact)	Physical State of Listed Substance[1]	Average Length of Exposure Per Day[2]	Number of Days per Year Exposed
A-F	14	Inhalation	GU	E	250
A-F	14	Direct Skin Contact	OL	NA	NA
I,N,O	11	Inhalation	GU	E	250
I,N,O	11	Direct Skin Contact	OL	NA	NA

[1] Use the following codes to designate the physical state of the listed substance at the point of exposure:

GC = Gas (condensible at ambient temperature and pressure)
GU = Gas (uncondensible at ambient temperature and pressure; includes fumes, vapors, etc.)
SO = Solid
SY = Sludge or slurry
AL = Aqueous liquid
OL = Organic liquid
IL = Immiscible liquid (specify phases, e.g., 90% water, 10% toluene)

[2] Use the following codes to designate average length of exposure per day:

A = 15 minutes or less
B = Greater than 15 minutes, but not exceeding 1 hour
C = Greater than one hour, but not exceeding 2 hours
D = Greater than 2 hours, but not exceeding 4 hours
E = Greater than 4 hours, but not exceeding 8 hours
F = Greater than 8 hours

[ ] Mark (X) this box if you attach a continuation sheet.

9.06 Complete the following table for each work area identified in question 9.05, and for each labor category at your facility that encompasses workers who may potentially come in contact with or be exposed to the listed substance. Photocopy this question

CBI and complete it separately for each process type and work area.

[__] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 2

Labor Category	Number of Workers Exposed	Mode of Exposure (e.g., direct skin contact)	Physical State of Listed Substance[1]	Average Length of Exposure Per Day[2]	Number of Days per Year Exposed
G,H,J,K	6	Inhalation	GU	E	250

[1]Use the following codes to designate the physical state of the listed substance at the point of exposure:

GC = Gas (condensible at ambient temperature and pressure)
GU = Gas (uncondensible at ambient temperature and pressure; includes fumes, vapors, etc.)
SO = Solid
SY = Sludge or slurry
AL = Aqueous liquid
OL = Organic liquid
IL = Immiscible liquid (specify phases, e.g., 90% water, 10% toluene)

[2]Use the following codes to designate average length of exposure per day:

A = 15 minutes or less
B = Greater than 15 minutes, but not exceeding 1 hour
C = Greater than one hour, but not exceeding 2 hours
D = Greater than 2 hours, but not exceeding 4 hours
E = Greater than 4 hours, but not exceeding 8 hours
F = Greater than 8 hours

[__] Mark (X) this box if you attach a continuation sheet.

9.06 Complete the following table for each work area identified in question 9.05, and for each labor category at your facility that encompasses workers who may potentially come in contact with or be exposed to the listed substance. Photocopy this question and complete it separately for each process type and work area.

CBI

[ ] Process type .... Flexible Polyrethane Foam Manu. Process

Work area 3

Labor Category	Number of Workers Exposed	Mode of Exposure (e.g., direct skin contact)	Physical State of Listed Substance[1]	Average Length of Exposure Per Day[2]	Number of Days per Year Exposed
L,M	2	Inhalation	GU	E	250

[1]Use the following codes to designate the physical state of the listed substance at the point of exposure:

GC = Gas (condensible at ambient temperature and pressure)
GU = Gas (uncondensible at ambient temperature and pressure; includes fumes, vapors, etc.)
SO = Solid
SY = Sludge or slurry
AL = Aqueous liquid
OL = Organic liquid
IL = Immiscible liquid (specify phases, e.g., 90% water, 10% toluene)

[2]Use the following codes to designate average length of exposure per day:

A = 15 minutes or less
B = Greater than 15 minutes, but not exceeding 1 hour
C = Greater than one hour, but not exceeding 2 hours
D = Greater than 2 hours, but not exceeding 4 hours
E = Greater than 4 hours, but not exceeding 8 hours
F = Greater than 8 hours

[ ] Mark (X) this box if you attach a continuation sheet.

9.07 For each labor category represented in question 9.06, indicate the 8-hour Time Weighted Average (TWA) exposure levels and the 15-minute peak exposure levels. Photocopy this question and complete it separately for each process type and work area.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 1-4

Labor Category	8-hour TWA Exposure Level (ppm, mg/m^3, other-specify)	15-Minute Peak Exposure Level (ppm, mg/m^3, other-specify)
A-O	* < 1.0 ppb	** 3.0 ppb

* Exposure Data Collected on Daily Basis

** Avg. 15 Minute Peak Exposure Level Based on 34 Incidences Measured Between 0-20 ppb over One (1) year of Monitoring Data (1988 Data)

[ ] Mark (X) this box if you attach a continuation sheet.

PART B WORK PLACE MONITORING PROGRAM

9.08 If you monitor worker exposure to the listed substance, complete the following table.

CBI

[ ]

Sample/Test	Work Area ID	Testing Frequency (per year)	Number of Samples (per test)	Who Samples[1]	Analyzed In-House (Y/N)	Number of Years Records Maintained
Personal breathing zone	1-3	Occasional	1	D	Y	8
General work area (air)	1-3	Daily	Continuous	D	Y	8
Wipe samples	NA	NA	NA	NA	NA	NA
Adhesive patches	NA	NA	NA	NA	NA	NA
Blood samples	NA	NA	NA	NA	NA	NA
Urine samples	NA	NA	NA	NA	NA	NA
Respiratory samples	NA	NA	NA	NA	NA	NA
Allergy tests	NA	NA	NA	NA	NA	NA
Other (specify)						
Other (specify)						
Other (specify)						

[1]Use the following codes to designate who takes the monitoring samples:

A = Plant industrial hygienist
B = Insurance carrier
C = OSHA consultant
D = Other (specify) Plant Personnel

[ ] Mark (X) this box if you attach a continuation sheet.

9.09 For each sample type identified in question 9.08, describe the type of sampling and
CBI analytical methodology used for each type of sample.

[ ]

Sample Type	Sampling and Analytical Methodology
Personal Breathing Zone	Personal Continuous Monitors
General Work Area	Stationary And Portable Monitors

9.10 If you conduct personal and/or ambient air monitoring for the listed substance, specify the following information for each equipment type used.

CBI

[ ]

Equipment Type[1]	Detection Limit[2]	Manufacturer	Averaging Time (hr)	Model Number
E	< .001 A	MDA Scientific	8	7100
E	< .001 A	MDA Scientific	8	7005
H	< .001 A	GMD Systems	0.15	900
D	< .001 A	GMD Systems	8	600-01

[1] Use the following codes to designate personal air monitoring equipment types:

A = Passive dosimeter
B = Detector tube
C = Charcoal filtration tube with pump
D = Other (specify) Personal Continuous Monitor

Use the following codes to designate ambient air monitoring equipment types:

E = Stationary monitors located within work area
F = Stationary monitors located within facility
G = Stationary monitors located at plant boundary
H = Mobile monitoring equipment (specify) Portable Auto-Step Monitor
I = Other (specify) ______

[2] Use the following codes to designate detection limit units:

A = ppm
B = Fibers/cubic centimeter (f/cc)
C = Micrograms/cubic meter (μ/m^3)

[ ] Mark (X) this box if you attach a continuation sheet.

9.11 If you conduct routine medical tests for monitoring the health effects of exposure to the listed substance, specify the type and frequency of the tests.

CBI

[ ]

Test Description	Frequency (weekly, monthly, yearly, etc.)
Pulmonary Function Studies	Yearly

[ ] Mark (X) this box if you attach a continuation sheet.

PART C ENGINEERING CONTROLS

9.12 Describe the engineering controls that you use to reduce or eliminate worker exposure to the listed substance. Photocopy this question and complete it separately for each process type and work area.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 1-4

Engineering Controls	Used (Y/N)	Year Installed	Upgraded (Y/N)	Year Upgraded
Ventilation:				
Local exhaust	Y	UK	Y	1986-88
General dilution	Y	UK	Y	1986-88
Other (specify)				
Vessel emission controls	N	NA	NA	NA
Mechanical loading or packaging equipment	N	NA	NA	NA
Other (specify)				

[ ] Mark (X) this box if you attach a continuation sheet.

9.13 Describe all equipment or process modifications you have made within the 3 years prior to the reporting year that have resulted in a reduction of worker exposure to the listed substance. For each equipment or process modification described, state the percentage reduction in exposure that resulted. Photocopy this question and complete it separately for each process type and work area.

CBI

[_] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 1

Equipment or Process Modification	Reduction in Worker Exposure Per Year (%)
Increase Dilution Exhaust Capacity in Tank Area	UK
Increase Local Exhaust Capacity (Foam Line)	UK
Increase Dilution Exhaust Capacity on Floor	UK
Enclosed Conveyors and Connected to Local Exhaust	UK

[X] Mark (X) this box if you attach a continuation sheet.

9.13 Describe all equipment or process modifications you have made within the 3 years prior to the reporting year that have resulted in a reduction of worker exposure to the listed substance. For each equipment or process modification described, state the percentage reduction in exposure that resulted. Photocopy this question and complete it separately for each process type and work area.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 2-3

Equipment or Process Modification	Reduction in Worker Exposure Per Year (%)
Increase Local Exhaust Capacity (Cut-Off Saw)	UK
Add Radiant Heaters to Reduce Cure Time	UK

[X] Mark (X) this box if you attach a continuation sheet.

9.13 Describe all equipment or process modifications you have made within the 3 years prior to the reporting year that have resulted in a reduction of worker exposure to the listed substance. For each equipment or process modification described, state the percentage reduction in exposure that resulted. Photocopy this question and complete it separately for each process type and work area.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 4

Equipment or Process Modification	Reduction in Worker Exposure Per Year (%)
Increase Exhaust Capacity in Curing Area	UK
Increase Dilution Exhaust Capacity in Short Block Curing Area	UK

[ ] Mark (X) this box if you attach a continuation sheet.

PART D PERSONAL PROTECTIVE AND SAFETY EQUIPMENT

9.14 Describe the personal protective and safety equipment that your workers wear or use in each work area in order to reduce or eliminate their exposure to the listed substance. Photocopy this question and complete it separately for each process type and work area.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work area 1-4

Equipment Types	Wear or Use (Y/N)
** Respirators	Y
Safety goggles/glasses	Y
** Face shields	Y
** Coveralls	Y
Bib aprons	N
Chemical-resistant gloves	Y
Other (specify)	
* ~~Self-Contained Breathing~~ Apparatus	Y
* ~~Escape Masks~~	Y

* For Emergency Use Only
** Used on an as Need Basis

[ ] Mark (X) this box if you attach a continuation sheet.

9.15 If workers use respirators when working with the listed substance, specify for each process type, the work areas where the respirators are used, the type of respirators used, the average usage, whether or not the respirators were fit tested, and the type and frequency of the fit tests. Photocopy this question and complete it separately for each process type.

CBI

[ ] Process type .... Flexible Polyurethane Foam Manu. Process

Work Area	Respirator Type	Average Usage[1]	Fit Tested (Y/N)	Type of Fit Test[2]	Frequency of Fit Tests (per year)
1-3	Comfo II Face Piece	E	Y	QT	When Issued

[1]Use the following codes to designate average usage:

A = Daily
B = Weekly
C = Monthly
D = Once a year
E = Other (specify) When Necessary

[2]Use the following codes to designate the type of fit test:

QL = Qualitative
QT = Quantitative

[ ] Mark (X) this box if you attach a continuation sheet.

PART E WORK PRACTICES

9.19 Describe all of the work practices and administrative controls used to reduce or eliminate worker exposure to the listed substance (e.g., restrict entrance only to authorized workers, mark areas with warning signs, insure worker detection and monitoring practices, provide worker training programs, etc.). Photocopy this question and complete it separately for each process type and work area.

CBI

[ ]

Process type ...... Flexible Polyurethane Foam Manu. Process

Work area 1-4

Exposure Monitoring, Respirator Protection, Training Program, Self-Contained Breathing Apparatus, Warning and Safety Procedure Signs Posted, Laundering Service, Neutralizer and Hazorb Sorbant, Spill Detection Alarms, Limited Access Diking, Portable Dams

9.20 Indicate (X) how often you perform each housekeeping task used to clean up routine leaks or spills of the listed substance. Photocopy this question and complete it separately for each process type and work area.

Process type ...... Flexible Polyurethane Foam Manu. Process

Work area 1-4

Housekeeping Tasks	Less Than Once Per Day	1-2 Times Per Day	3-4 Times Per Day	More Than 4 Times Per Day
Sweeping		X		
Vacuuming				
Water flushing of floors				
Other (specify)				
* Emergency - Immediate Clean-up,Diking, Absorbant				

[ ] Mark (X) this box if you attach a continuation sheet.

9.21 Do you have a written medical action plan for responding to routine or emergency exposure to the listed substance?

Routine exposure

Yes 1

No 2

Emergency exposure

Yes 1

No 2

If yes, where are copies of the plan maintained?

Routine exposure: Medical Dept. Plt #2, Plt #4, Receiving Dept., Maintenance Dept. R&D

Emergency exposure: Same As Above

9.22 Do you have a written leak and spill cleanup plan that addresses the listed substance? Circle the appropriate response.

Yes 1

No 2

If yes, where are copies of the plan maintained? R&D, Plt #2, Plt #4, Receiving Dept., Local and State Agencies, Local Fire Dept.

Has this plan been coordinated with state or local government response organizations? Circle the appropriate response.

Yes 1

No 2

~~9.23~~ Who is responsible for monitoring worker safety at your facility? Circle the appropriate response.

Plant safety specialist 1

Insurance carrier 2

OSHA consultant 3

Other (specify) R&D Dept./ Plant Supervision 4

[_] Mark (X) this box if you attach a continuation sheet.

SECTION 10 ENVIRONMENTAL RELEASE

General Instructions:

Complete Part E (questions 10.23-10.35) for each non-routine release involving the listed substance that occurred during the reporting year. Report on all releases that are equal to or greater than the listed substance's reportable quantity value, RQ, unless the release is federally permitted as defined in 42 U.S.C. 9601, or is specifically excluded under the definition of release as defined in 40 CFR 302.3(22). Reportable quantities are codified in 40 CFR Part 302. If the listed substance is not a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and, thus, does not have an RQ, then report releases that exceed 2,270 kg. If such a substance however, is designated as a CERCLA hazardous substance, then report those releases that are equal to or greater than the RQ. The facility may have answered these questions or similar questions under the Agency's Accidental Release Information Program and may already have this information readily available. Assign a number to each release and use this number throughout this part to identify the release. Releases over more than a 24-hour period are not single releases, i.e., the release of a chemical substance equal to or greater than an RQ must be reported as a separate release for each 24-hour period the release exceeds the RQ.

For questions 10.25-10.35, answer the questions for each release identified in question 10.23. Photocopy these questions and complete them separately for each release.

PART A GENERAL INFORMATION

10.01 Where is your facility located? Circle all appropriate responses.

CBI

[ ] Industrial area 1

Urban area 2

Residential area 3

Agricultural area 4

Rural area 5

Adjacent to a park or a recreational area 6

Within 1 mile of a navigable waterway 7

Within 1 mile of a school, university, hospital, or nursing home facility 8

Within 1 mile of a non-navigable waterway 9

Other (specify) ____________ 10

[ ] Mark (X) this box if you attach a continuation sheet.

10.02 Specify the exact location of your facility (from central point where process unit is located) in terms of latitude and longitude or Universal Transverse Mercader (UTM) coordinates.

Latitude .... 40 ° 57 ' 30 "

Longitude .... 75 ° 58 ' 30 "

UTM coordinates .... Zone 18, Northing 414.00, Easting 4536.5

~~10.03~~ If you monitor meteorological conditions in the vicinity of your facility, provide the following information.

Average annual precipitation .... ________ inches/year

Predominant wind direction .... ________

~~10.04~~ Indicate the depth to groundwater below your facility.

Depth to groundwater .... ________ meters

10.05 For each on-site activity listed, indicate (Y/N/NA) all routine releases of the listed substance to the environment. (Refer to the instructions for a definition of Y, N, and NA.)

CBI

[ ]

On-Site Activity	Environmental Release Air	Water	Land
Manufacturing	NA	NA	NA
Importing	NA	NA	NA
Processing	Y	N	N
Otherwise used	~~NA~~	~~NA~~	~~NA~~
Product or residual storage	Y	N	N
Disposal	NA	NA	NA
Transport	NA	NA	NA

[ ] Mark (X) this box if you attach a continuation sheet.

10.06 Provide the following information for the listed substance and specify the level of precision for each item. (Refer to the instructions for further explanation and an example.)

CBI

[ ]

Quantity discharged to the air	* 77.0	kg/yr ±	20	%
Quantity discharged in wastewaters	NA	kg/yr ±	0	%
Quantity managed as other waste in on-site treatment, storage, or disposal units	NA	kg/yr ±	0	%
Quantity managed as other waste in off-site treatment, storage, or disposal units	NA	kg/yr ±	0	%

* (Data Based on Extrapolation of Limited Monitoring Data)

[ ] Mark (X) this box if you attach a continuation sheet.

10.08 Describe the control technologies used to minimize release of the listed substance for each process stream containing the listed substance as identified in your process block or residual treatment block flow diagram(s). Photocopy this question and complete it separately for each process type.

CBI

[_] Process type ...... __________

Stream ID Code	Control Technology	Percent Efficiency
	NA	

[_] Mark (X) this box if you attach a continuation sheet.

PART B RELEASE TO AIR

10.09 Point Source Emissions -- Identify each emission point source containing the listed substance in terms of a Stream ID Code as identified in your process block or residual treatment block flow diagram(s), and provide a description of each point source. Do not include raw material and product storage vents, or fugitive emission sources (e.g., equipment leaks). Photocopy this question and complete it separately for each process type.

CBI

[ ]

Process type ...... Flexible Polyurethane Foam Manu. Process

Point Source ID Code	Description of Emission Point Source
7HH	Exhaust from Cut-Off Saw
7V,7Y,7BB	Vent From Process Tunnel
7GG	Vent From Foam Storage/Curing Area

[ ] Mark (X) this box if you attach a continuation sheet.

[_] Mark (X) this box if you attach a continuation sheet.

10.10 Emission Characteristics - - Characterize the emissions for each Point Source ID Code identified in question 10.09 by completing the following table.

CBI

[_]

Point Source ID Code	Physical State[1]	Average Emissions (kg/day)	Frequency[2] (days/yr)	Duration[3] (min/day)	Average Emission Factor[4]	Maximum Emission Rate (kg/min)	Maximum Emission Rate Frequency (events/yr)	Maximum Emission Rate Duration (min/event)
7V,7Y,7BB 7HH	V	0.22	250	240	NA	0.0016	250	30
7GG	V	0.08	250	240	NA	NA	NA	NA
7II,7KK	V	0.01	100	120	NA	NA	NA	NA

[1]Use the following codes to designate physical state at the point of release:
G = Gas; V = Vapor; P = Particulate; A = Aerosol; O = Other (specify) ______

[2]Frequency of emission at any level of emission

[3]Duration of emission at any level of emission

[4]Average Emission Factor — Provide estimated (± 25 percent) emission factor (kg of emission per kg of production of listed substance)

10.11 Stack Parameters -- Identify the stack parameters for each Point Source ID Code identified in question 10.09 by completing the following table.

CBI

[ ]

Point Source ID Code	Stack Height(m)	Stack Inner Diameter (at outlet) (m)	Exhaust Temperature (°C)	Emission Exit Velocity (m/sec)	Building Height(m)[1]	Building Width(m)[2]	Vent Type[3]
7V,7Y ~~7BB~~	3m	1.22m 0.45m	Ambient	8m/s	10m	27m	V
7GG	3m	1.22m 0.45m	Ambient	8m/s	10m	40m	V
~~7II,7KK~~	~~3m~~	~~0.07m~~	~~Ambient~~	~~0.05m/s~~	~~10m~~	~~27to40m~~	~~V~~
~~7HH~~	~~NA~~	~~1m~~	~~Ambient~~	8m/s	10m	40m	H

[1]Height of attached or adjacent building

[2]Width of attached or adjacent building

[3]Use the following codes to designate vent type:

H = Horizontal
V = Vertical

[ ] Mark (X) this box if you attach a continuation sheet.

10.12 If the listed substance is emitted in particulate form, indicate the particle size distribution for each Point Source ID Code identified in question 10.09. Photocopy this question and complete it separately for each emission point source.

CBI

[_]

Point source ID code .... NA

Size Range (microns)	Mass Fraction (% ± % precision)
< 1	NA
≥ 1 to < 10	NA
≥ 10 to < 30	NA
≥ 30 to < 50	NA
≥ 50 to < 100	NA
≥ 100 to < 500	NA
≥ 500	NA
	Total = 100%

[_] Mark (X) this box if you attach a continuation sheet.

PART C FUGITIVE EMISSIONS

10.13 Equipment Leaks -- Complete the following table by providing the number of equipment types listed which are exposed to the listed substance and which are in service according to the specified weight percent of the listed substance passing through the component. Do this for each process type identified in your process block or residual treatment block flow diagram(s). Do not include equipment types that are not exposed to the listed substance. If this is a batch or intermittently operated process, give an overall percentage of time per year that the process type is exposed to the listed substance. Photocopy this question and complete it separately

CBI for each process type.

[ ] Process type ..... Flexible Polyurethane Foam Manu. Process

Percentage of time per year that the listed substance is exposed to this process type .... 100 %

Equipment Type	Number of Components in Service by Weight Percent of Listed Substance in Process Stream					
	Less than 5%	5-10%	11-25%	26-75%	76-99%	Greater than 99%
Pump seals[1]						
Packed						
Mechanical						2
Double mechanical[2]						
Compressor seals[1]						
Flanges	35					50
Valves						
Gas[3]						
Liquid	25					45
Pressure relief devices[4] (Gas or vapor only)						10
Sample connections						
Gas						
Liquid						2
Open-ended lines[5] (e.g., purge, vent)						
Gas	5					
Liquid						

[1] List the number of pump and compressor seals, rather than the number of pumps or compressors

10.13 continued on next page

[ ] Mark (X) this box if you attach a continuation sheet.

10.13 (continued)

[2]If double mechanical seals are operated with the barrier (B) fluid at a pressure greater than the pump stuffing box pressure and/or equipped with a sensor (S) that will detect failure of the seal system, the barrier fluid system, or both, indicate with a "B" and/or an "S", respectively

[3]Conditions existing in the valve during normal operation

[4]Report all pressure relief devices in service, including those equipped with control devices

[5]Lines closed during normal operation that would be used during maintenance operations

10.14 Pressure Relief Devices with Controls -- Complete the following table for those pressure relief devices identified in 10.13 to indicate which pressure relief devices in service are controlled. If a pressure relief device is not controlled, enter "None" under column c.

CBI

[_]

a. Number of Pressure Relief Devices	b. Percent Chemical in Vessel[1]	c. Control Device	d. Estimated Control Efficiency[2]
5	100%	~~Rupture Disc~~	~~100%~~
5	100%	Spring-OverPressure ~~Pressure Relief~~	~~100%~~

[1]Refer to the table in question 10.13 and record the percent range given under the heading entitled "Number of Components in Service by Weight Percent of Listed Substance" (e.g., <5%, 5-10%, 11-25%, etc.)

[2]The EPA assigns a control efficiency of 100 percent for equipment leaks controlled with rupture discs under normal operating conditions. The EPA assigns a control efficiency of 98 percent for emissions routed to a flare under normal operating conditions

[_] Mark (X) this box if you attach a continuation sheet.

10.15 Equipment Leak Detection -- If a formal leak detection and repair program is in place, complete the following table regarding those leak detection and repair procedures. Photocopy this question and complete it separately for each process type.

CBI

[ ] Process type .... TDI Usage in Manu.

Equipment Type	Leak Detection Concentration (ppm or mg/m^3) Measured at ____ Inches from Source	Detection Device[1]	Frequency of Leak Detection (per year)	Repairs Initiated (days after detection)	Repairs Completed (days after initiated)
Pump seals					
Packed	NA				
Mechanical	NA				
Double mechanical	NA				
Compressor seals	NA				
Flanges	NA				
Valves					
Gas	NA				
Liquid	NA				
Pressure relief devices (gas or vapor only)	NA				
Sample connections					
Gas	NA				
Liquid	NA				
Open-ended lines					
Gas	NA				
Liquid	NA				

[1]Use the following codes to designate detection device:

POVA = Portable organic vapor analyzer
FPM = Fixed point monitoring
O = Other (specify) ______

[ ] Mark (X) this box if you attach a continuation sheet.

[ ] Mark (X) this box if you attach a continuation sheet.

10.16 Raw Material, Intermediate and Product Storage Emissions - - Complete the following table by providing the information on each liquid raw material, intermediate, and product storage vessel containing the listed substance as identified in your process block or residual treatment block flow diagram(s).

CBI

[ ]

Vessel Type[1]	Floating Roof Seals[2]	Composition of Stored Materials[3]	Throughput (liters per year)	Vessel Filling Rate (gpm)	Vessel Filling Duration (min)	Vessel Inner Diameter (m)	Vessel Height (m)	Operating Vessel Volume (l)	Vessel Emission Controls[4]	Design Flow Rate[5]	Vent Diameter (cm)	Control Efficiency (%)	Basis for Estimate[6]
P	NA	100%	UK	60	160	3.6	4	36,400	NA	NA	7.6	NA	NA
~~P~~	~~NA~~	~~100%~~	~~UK~~	~~60~~	~~160~~	~~3.6~~	~~4~~	~~36,400~~	~~NA~~	~~NA~~	~~7.6~~	~~NA~~	~~NA~~
H	NA	100%	UK	60	300	3	3	76,800	NA	NA	7.6	NA	NA
H	NA	100%	UK	60	300	3	3	76,800	NA	NA	7.6	NA	NA
~~H~~	~~NA~~	~~100%~~	~~UK~~	~~60~~	~~300~~	~~3~~	~~3~~	~~85,500~~	~~NA~~	~~NA~~	~~7.6~~	~~NA~~	~~NA~~
P	NA	100%	UK	60	300	2.5	4	17,100	NA	NA	7.6	NA	NA

[1]Use the following codes to designate vessel type:

F = Fixed roof
CIF = Contact internal floating roof
NCIF = Noncontact internal floating roof
EFR = External floating roof
P = Pressure vessel (indicate pressure rating)
H = Horizontal
U = Underground

[2]Use the following codes to designate floating roof seals:

MS1 = Mechanical shoe, primary
MS2 = Shoe-mounted secondary
MS2R = Rim-mounted, secondary
LM1 = Liquid-mounted resilient filled seal, primary
LM2 = Rim-mounted shield
LMW = Weather shield
VM1 = Vapor mounted resilient filled seal, primary
VM2 = Rim-mounted secondary
VMW = Weather shield

[3]Indicate weight percent of the listed substance. Include the total volatile organic content in parenthesis

[4]Other than floating roofs

[5]Gas/vapor flow rate the emission control device was designed to handle (specify flow rate units)

[6]Use the following codes to designate basis for estimate of control efficiency:

C = Calculations
S = Sampling

PART E NON-ROUTINE RELEASES

10.23 Indicate the date and time when the release occurred and when the release ceased or was stopped. If there were more than six releases, attach a continuation sheet and list all releases.

Release	Date Started	Time (am/pm)	Date Stopped	Time (am/pm)
1	NA			
2				
3				
4				
5				
6				

10.24 Specify the weather conditions at the time of each release.

Release	Wind Speed (km/hr)	Wind Direction	Humidity (%)	Temperature (°C)	Precipitation (Y/N)
1	NA				
2					
3					
4					
5					
6					

[_] Mark (X) this box if you attach a continuation sheet.

Fate of TDI and MDI in Air, Soil, and Water

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ABSTRACT

Toluene diisocyanate (TDI) and methylene diphenylene diisocyanate (MDI) are used in the production of polyurethanes. They can cause respiratory problems at very low concentrations, and workplace and emission levels have been subject to rigorous controls for many years. As a result of these controls, and the very low vapour pressures of the products and their variants, environmental pollution due to emissions or spillages is very low.

III has sponsored a range of studies to determine the fate of TDI and MDI in air, soil and water. Studies of simulated atmospheric conditions indicate that TDI is destroyed predominantly by OH radicals, without the formation of toluene diamine (TDA). TDA or MDA (methylene dianilene), if generated in the atmosphere from any source, are also destroyed by OH radical attack, and no accumulation of these products is expected.

In soil and water TDI and MDI are converted to polyureas, which are chemically inert, and which appear to cause no toxicological effects. The initial rate of reaction of TDI and MDI with water is relatively fast, but in many conditions the resulting polyurea products encapsulate agglomerations of the diisocyanates and rates of reactions decrease rapidly. Under aquatic conditions TDA and MDA are produced in low, transient, concentrations. Studies of the interactions of TDI and MDI with bioaquatic systems are difficult to execute consistently, due to the problem of formulating and controlling suitable conditions of chemical addition. However, the broad overview is that the ecological impact of such interactions is likely to be slight and reversible. III continues its work in these fields.

INTRODUCTION

Polyurethanes are remarkable materials which are used in many aspects of modern life, including insulation, furnishing, construction, surface coatings, sport and medical care. In recent years a range of diisocyanates have been introduced in the manufacture of polyurethanes, but toluene diisocyanate (TDI) and methylene diphenylene diisocyanate (MDI) still dominate the field. World production of each is currently approaching 1 million tons per annum. The International Isocyanate Institute, Inc. (III) is an association of manufacturers of TDI and MDI, and its Member Companies produce a very large proportion of total world tonnage. The main aim of III is the promotion of the safe handling of TDI and MDI, and it has made a major contribution to our knowledge of the enviornmental effects of TDI and MDI through project sponsorship. Some of those projects are discussed here, within the context of the physical and chemical properties of TDI and MDI.

It has been known for many years that TDI and MDI can cause respiratory effects at very low concentrations. Accordingly, the production, handling, distribution, use and emission of these materials has been subject to increasingly rigorous control by the industry and regulatory bodies, to protect workers and the population at large. This has given rise to benefits in terms of environmental effects. As a result of engineering controls and well-defined procedures, large spillages are infrequent and usually dealt with effectively, and levels of emission are normally very low.

PRODUCTS AND PROPERTIES

TDI and MDI are supplied to the polyurethane industry as a variety of products, designed to give a range of handling characteristics and polyurethane product properties. These include 80/20-TDI, 65/35-TDI, TDI prepolymers, polymeric MDI, monomeric MDI, and variants of both types of MDI. Of these products 80/20-TDI and polymeric MDI still predominate: some of their physical properties (along with those of monomeric MDI) are given in Table 1.

TDI is sometimes referred to as a "highly reactive and volatile substance." Both points require qualification. The reactivity of TDI (to water and polyols) is normally only observed in catalysed chemical systems used for the production of polyurethanes. We shall see that in the environ-

*Current address: III Safety Office, P.O. Box 42, Hexagon House, Blackley, Manchester, M9 3DA, England.

Table 1. Some properties of TDI and MDI [1,2,3,4,5].

Property		TDI* 80/20		MDI Polymeric	MDI Monomeric
State at 25 °C		liquid		liquid	solid
S.G. at 25 °C	g/cm^3	1.21		1.23	1.22
Melting Point	°C	ca. 15		< 10	38
Boiling Point	°C	251		Polymerizes at ca 250 °C with evolution of CO_2	171 at 1.33 mbar 200 at 6.6 mbar 230 decomposition
Vapour Pressure	mbar		(V.P. TDI/ V. P. water)		
	T = 0 °C	33×10^{-4}	(5×10^{-4})		
	25 °C	33×10^{-3}	(10×10^{-4})	$< 10^{-5}$	$< 10^{-5}$
	35 °C	75×10^{-3}	(13×10^{-4})		
Equilibrium Vapour Concentration at 25 °C	mg/m^3 (ppm)	220 (30)		ca 0.09 (0.009)	0.09 (0.009)
Flash Point**	°C	135		230	212

*80/20 TDI is 80% 2,4-TDI, 20% 2,6-TDI.
**Cleveland Open Cup, ASTM D92.

ment the rate of reaction of TDI with water depends on a variety of factors. As regards volatility, TDI has much lower equilibrium vapour pressures than does water. Over the range 0–35 °C those of TDI are ca 1000 times lower than those of water (see Table 1). At 25 °C the equilibrium vapour concentration of TDI is 30 ppm: those for polymeric and pure MDI are considerably lower. The equilibrium vapour concentrations of modified MDIs and TDIs are even lower than those of the parent isocyanates. In Figure 1 is given the generally accepted sequence of reactions following the interaction of TDI with water.

Further reactions will almost certainly take place at the remaining NCO groups. A similar sequence can be illustrated for MDI. The unstable intermediate produced decomposes to the amine with the liberation of CO_2, and the amine reacts immediately with more diisocyanate to yield a polyurea. However, as Saunders and Frisch [6] point out, the interactions of diisocyanates and water are complex and may involve several mechanisms. It is a common misconception that in the presence of water TDI is converted to toluene diamine (TDA) in stoichiometric proportions. This is certainly not the case, but an important question is to what extent TDI (or MDI) gives rise to traces of TDA (or MDA—methylene dianiline) in the environment, in view of the toxic properties of aromatic amines.

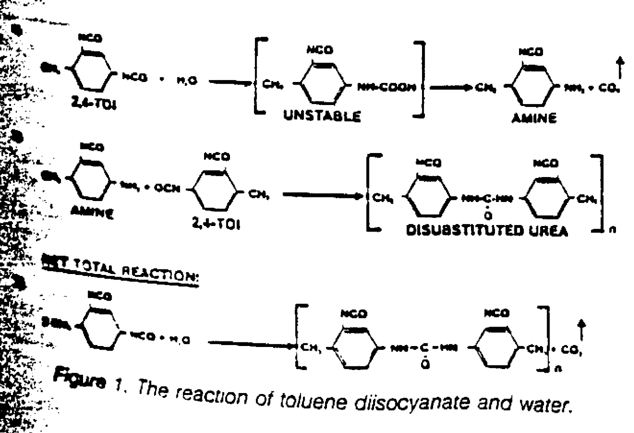

Figure 1. The reaction of toluene diisocyanate and water.

EMISSIONS INTO THE AIR

Sources

TDI is used very predominantly for the production of flexible foam slabstock and moulding. Emissions from these processes are known to be richer in 2,6-TDI than is the 80/20 TDI starting material [7]. TDI emissions are often vented to atmosphere, but concentrations are rather low. In a study of six W. German flexible foam factories in 1979, the University of Stuttgart found [8] that stack concentrations were in the range 3–8 mg/m^3, which represented about 0.005% of the total TDI used. In the UK and some states of the USA there are very rigorous requirements regarding emissions: "fenceline" concentrations of the order 0.003 mg/m^3 (0.0004 ppm TDI) or lower are required in some cases.

As regards MDI, typical emission levels are more difficult to quantify, due to the diversity of applications and wide variety of MDIs (prepolymers and variants) which are used. According to the application the emissions may comprise (a) MDI vapour, (b) MDI aerosol (and vapour), or (c) reacting mix aerosol (and vapour) which will be converted predominantly to a polyurethane. In many applications emission levels are much lower than those from TDI flexible foam processes. About half of the MDI produced is used in moulding (or refrigerator) manufacture, which usually give extremely low emission levels. The British Rigid Urethane Foam Manufacturers' Association has carried out a recent survey [9] of Member Companies' polyurethane production facilities, in which insulation board is produced by spray and liquid laydown techniques, and rigid foam slabstock is produced by both continuous and discontinuous techniques: their production comprises about 50% of total UK rigid foam manufacture. Normal emission levels were found to be 0.2 mg/m^3 or lower with occasional excursions above that level.

Developments in polyurethane processing and the control of emissions are leading to improved environmental conditions. Noteworthy here are (a) increasing use of RIM closed-circuit moulding technology and (b) developments in the carbon absorption of emissions [10]. Discussions

1,12] are in progress in the flexible foam industry to assess the viability of co-absorption of TDI and chlorofluorocarbon emissions, with subsequent recovery of the latter.

The Fate of TDI in the Atmosphere

Several workers [13–16] have carried out studies to investigate the kinetics and reaction products of TDI in the atmosphere. Most of these have been reviewed by Holdren et al. [17]. The results of work in this field should be considered in the light of (a) the highly adsorptive properties of TDI and (b) the possible conversion of TDI to TDA under the conditions of sampling and analysis: similar considerations apply to MDI. Walker and Pinches [18] sampled ambient air in flexible foam factories and concluded that appreciable quantities of TDA had been formed from TDI in the atmosphere. Sandridge [19], in a critique of the study, explained their findings in terms of interfering species in the analyses. Walker acknowledged [20] this possibility and agreed that their conclusions might have been erroneous, or at least, premature. Similar results have not been reported since.

A major study [17,21] on this topic has been carried out by Holdren, Spicer, and Riggin of the Battelle Institute, Columbus, Ohio, U.S.A. Experiments were carried out in a large (17 m^3) chamber, lined with PTFE sheeting, in order to minimize wall effects. A series of atmospheres were generated in the chamber to simulate environmental conditions and to determine the parameters giving rise to loss of TDI from the gas phase. Experiments were carried out both in darkness and with irradiation. An important feature of the work was the use of many instrumental techniques to analyse the atmospheres. An assessment of the effects of the following was made (a) photolytic decomposition, (b) photochemically induced pollutants (eg., O_3, OH radicals), (c) urban hydrocarbon mixture and ammonium sulphate particles, (d) TEDA (triethylene diamine), a very commonly used catalyst and (e) possible conversion of TDI to TDA. Outline results of the study are given in Table 2: the final column gives the net loss rates, obtained by subtracting the wall loss rates from the average removal rates.

It was found that under the experimental conditions:

(a) The first order loss rate of TDI from the vapour phase in humid air (7–70% R.H.) and darkness was rather low (ca. 15% per hour).
(b) Irradiation caused an increase in loss rate (by ca. 20% per hour), the increase being mainly attributable to free radical attack. The loss rate was little affected by the presence of a variety of common atmospheric pollutants.
(c) The rate of TDI loss increased very considerably (by 44% per hour) when the level of TEDA vapour was increased from 0.2 ppm to 2 ppm under irradiation conditions.
(d) No TDA was found above the detection limit of 10 ng/ml, which would correspond to a maximum conversion of 0.05% TDI to TDA.
(e) Surface absorption onto the chamber lining was a significant removal mechanism.

The above findings indicate that TDI which is emitted during daylight hours has a half-life of about 3 hours, which is little affected by common atmospheric pollutants, and which is independent of relative humidity (7–70%). The loss rate may be affected by the presence of TEDA under factory conditions, although TEDA emission levels are normally well below 2 ppm in flexible foam manufacture, it is believed. There are other tertiary aliphatic amine catalysts, more volatile than TEDA (notably N-ethyl morpholine), which might affect TDI loss rates in practice. A study of emission levels of a range of amine catalysts used in flexible foam technology is currently in progress [22].

Fate of TDA, MDA and TDI under Photolytic Conditions

Theoretical considerations [23] indicate that direct formation of TDA (or MDA) from the corresponding diisocyanates by atmospheric hydrolysis processes is very unlikely, and the Battelle study results support this. Whilst it seemed unlikely that appreciable concentrations of TDA (or MDA) would arise from airborne TDI (or MDI),

Table 2. TDI removal rates.

Experiment	Urban Mix	Irradiation	TEDA	Other Species	Avg. TDI Removal Rate hr^{-1}	Net Loss Rate (TDI Removal Rate Minus Wall Loss Rate) hr^{-1}
1	No	No	No	—	0.15*	0
2	No	Yes	No	—	0.36	0.21
3	Yes	Yes	No	—	0.36	0.21
4	Yes	Yes	No	0.5 ppm Ammonia	0.33	0.18
5	Yes	Yes	2 ppm	—	0.99	0.84
6	Yes	Yes	No	100µg/m³ Ammonium Sulphate	0.40	0.25
7	No	No	No	—	0.35	0
8	No	Yes	No	4 ppm Nitrous Oxide	0.38	0.03
9	Yes	No	0.2 ppm	—	0.36	0.01
10	Yes	Yes	0.2 ppm	—	0.55	0.20

*0.15/hr = 15%/hr (see text).

III funded a study to investigate the fate of airborne TDA and MDA, to address their possible formation from any source. The gas phase decomposition of TDI was also investigated. Present knowledge [24] indicates that tropospheric degradation of trace gases (excluding olefinic substances) are predominantly determined by their reactions with OH radicals. (The Battelle study had already indicated that free radical attack is a much more important mechanism than direct photolysis in gas-phase TDI loss.) Accordingly, the study [23], which was carried out by Becker, Bastian and Klein of Wuppertal University, F.R.G., was of OH radical attack. The reaction vessel was a 420 litre glass cylinder into which was introduced the given test substance at atmospheric pressure. Hydroxy radicals were generated by the photolysis of methyl nitrite in the presence of NO to prevent the formation of O_3 and NO_3 radicals. The loss rate of the test substance was compared with that of a reference material at 25°C, using long-path FT-IR absorption spectroscopy. The conditions of the experiments were such that the results relate only to gas phase losses, and not to deposition rates or heterogeneous reactions. Decomposition products were not investigated.

Tropospheric half lives (τ) under simulated conditions for the first order bimolecular reaction of the test substance with OH radical (concentration [OH]) were derived from the rate constants k_{OH}, where:

$$\tau = 0.69\ (k_{OH} \times [OH])^{-1}$$

The results, along with those of some other substances as cited by Becker and co-workers, are given in Table 3.

The results indicate that under simulated atmospheric conditions the OH radical-initiated reactions of MDA and TDA are relatively fast and more rapid than those of TDI and of several hydrocarbons, for example. Under such conditions, the rate-determining step of a possible sequence:

$$\text{generation of airborne TDI} \longrightarrow \text{airborne TDA} \xrightarrow{OH^{\cdot}} \text{products}$$

would be the generation of airborne TDI, and no accumulation of atmospheric TDA would result.

The investigators also studied gas-phase OH radical attack of TDI. The decay rate (0.053 hr^{-1}) was lower than that found by the Battelle Group (0.21 hr^{-1}), but they concluded that this was not unexpected in view of the scatter of results and not fully comparable experimental design. Experiments were carried out at 25°C and 28°C, respectively.

Combustion of TDI and MDI

Fire parameters of TDI and MDI have been studied under laboratory conditions [3,25]. The results are in accordance with practical experience, notably that they are ignited only with difficulty and do not support combustion easily. Their resistance to ignition is reflected in their flash points (Table 1), which are relatively high, compared to those of many products which are transported and stored under similar conditions [3]. Apart from the carefully controlled destruction of TDI and MDI in incinerator, it is likely that they would only be burnt in large accidental fires. It is expected that the combustion products would not be dissimilar to those from a range of natural and synthetic nitrogen-containing compounds, and that no unique harmful products would be formed.

Table 3. Hydroxyl radical attack of various substances.

Substance	Tropospheric 1/2 Lifetimes (hr)
TDI (80:20)	13.0
TDA (2,4-)	0.5
TDA (2,6-)	1.0
MDA	3.2
Propane	82.0
Toluene	15.6
Aniline	0.8

SOIL AND WATER

TDI and MDI may come into contact with soil or water following accidental spillage. Experience gained from such spillages indicates that they are usually well contained. Monomeric MDI (mp 38°C), when handled as a liquid, solidifies on contact with soil or water. Under many circumstances TDI (mp ca. 15°C) and many modified TDIs and MDIs solidify, too. Polymeric MDI solidifes only at low temperatures not usually encountered in the environment. However, polymeric MDI, as well as the other materials under consideration, has specific gravity and viscosity greater than those of water, and experience indicates that it rapidly sinks in water without becoming finely divided. This effect has even been observed in a fast-flowing stream.

Agglomerations of MDI and TDI react with water to form a hard crust of inert, water-insoluble material comprising polyureas. Analysis of such polymeric materials is very difficult and precise work on their composition has not been carried out. However, the products of reaction of polymeric MDI and 80/20 TDI with water investigated in animal studies have been found to give no observable acute effects. LD 50 values for both polymeric MDI- and 80/20 TDI-based polyureas were found [26] to be >15 g/kg in rats (single gavages in peanut oil, period of observation 14 days, no fatalities).

Soil

Information on the interaction of isocyanates with soil or sand is important in terms of (a) the impact of accidental spillage onto soil and (b) the efficacy and possible environmental effects of using wet soil or sand as a means of decontaminating a spillage area. Large accidental spillages are usually decontaminated by the application of large quantities of water or by covering and mixing the diisocyanate with wet earth. The use of wet earth or sand is preferable, wherever local conditions allow it, because the diisocyanate remains localised and the mixture, when inactive, can be disposed of easily. Washing away material, especially from an impervious surface such as a factory floor or road, could cause further distribution of reacting

Table 4. Analysis of TDI (+TDA) in soil samples.

After 1 week	TDI (+ TDA) = 0.20 to 100 ppm by wt.
After 6 weeks	TDI (+ TDA) = 0.06 to 1.0 ppm by wt.
After 1 year	TDA not detected (detection limit 0.1 ppm)
After 6 years	TDA not detected at 20–100 cm depth (detection limit 0.05 ppm)

material, and in a more finely divided state if high pressure hosing is used.

Studies on models have been carried out (a) to simulate the covering of a TDI spillage with wet sand and (b) to assess the chemical stability of polyureas prepared from ^{14}C-labelled MDI and TDI in different agricultural soils. In addition, a study has been carried out on the environmental impact of an actual large spillage of TDI. These have been reviewed elsewhere [27,28], but the main points are outlined below.

The results [29] of model experiments indicated that TDI in undisturbed wet sand (coarse or fine) is converted to polyureas at a rapidly decreasing rate. After 24 hours, 5.5% of the original TDI was unreacted and after 8 days 3.5% remained. These findings can be explained in terms of the encapsulation of TDI within a forming crust of polyurea, which impedes the further penetration of water. No TDA was found above the detection limit of 0.01 ppm. In a separate study [30] the possible degradation of polyureas prepared from ^{14}C-labelled MDI and TDI was studied in different agricultural soils. No degradation was detected: $^{14}CO_2$ was not evolved, indicating that TDA was not formed.

In April 1975 a road accident occurred, as a result of which 14 tons of TDI were deposited on marshy ground. The spillage was covered with absorbent materials (mainly sand). A six-year study [31] was carried out in close collaboration with the local authority to investigate the consequences of the incident. Outline findings are given in Table 4. No TDI (or TDA) were found in a brook connected to the marsh after intervals of 10 days and 12 weeks.

Analysis of samples at the 1-week and 6-week stages was carried out by a method which did not distinguish between TDI and TDA. It is assumed from the studies reported above that TDI was the predominant species. The results are again compatible with the encapsulation of TDI by a polyurea crust. It is noteworthy that the vegetation at the site of the incident had developed normally during July 1975: grass grew normally, new foliage appeared on trees and flowers bloomed.

Water

III has funded a number of studies on the chemical and biological effects of MDI, MDA, TDI, and TDA in marine and river water models [32–35]. In addition, Curtis et al. [36] have investigated the toxicity of TDI to freshwater and saltwater organisms. Duff [27], and Brochhagen and Grieveson [28] have reviewed the above findings. Fujiwara [32] carried out studies on the presence of TDI, TDA, MDI, and MDA in marine and river water and in polyurea crusts, following the addition of the respective diisocyanates to the systems. Observations on the river model were made during spring, summer, autumn, and winter. Low concentrations of both diisocyanates and the respective diamines were found in most cases on day 1, but these were transient. It is not foreseen that aquatic life would be subject to long-term exposure from TDI, TDA, MDI, or MDA following a spillage of MDI or TDI. III studies devoted only to the effects of MDA and TDA on aquatic life will be reviewed in a future publication.

Caspers, Hamburger, Kanne, and Klebert [34] of Bayer AG, Leverkusen, F.R.G., have recently completed a comprehensive study for III of the effects of TDI and MDI (also TDA and MDA) on aquatic life, following OECD Guidelines 302C, 209, 202, and 203. Their outline results are presented in Table 5.

The results should be taken as indicators of the general overview of the immediate effects of acute exposure. Details of the methodology and analysis of the results, as presented in the original report, are required for an in-depth interpretation of the study. The findings, which are broadly in agreement with those of other workers [32,33], indicate that:

(a) The reaction products of TDI and MDI with water do not biodegrade readily.
(b) TDI and MDI are not appreciably toxic to bacteria.
(c) When dispersed in water with moderate efficiency, MDI and TDI are not appreciably toxic to daphnia: no negative effects on their reproduction were found at the highest concentrations used.
(d) Results on the toxicity of MDI and TDI to fish were rather inconsistent and the authors comment that harmful effects due to oral ingestion or mechanical violation of body tissues could not be excluded. The broad finding was that the immediate toxic effects of MDI and TDI due to acute exposure are rather low.

The investigators carried out several tests with very high shear stirring, and found increased fish and daphnia toxicity under such conditions: the results are not included here since such conditions could not be foreseen in the environment. A simple understanding of the acute fish toxicity of TDI and MDI can not be gained from the different LC 50 results of Hamburger et al., obtained at different stirring rates, taken along with the results of Fujiwara and Curtis et al., who each used different species and different experimental conditions. This is not unexpected. Such studies with MDI and TDI are especially difficult to interpret because of the inherent problem that the chemicals are almost totally insoluble in, and react with, the

Table 5. Results of Hamburger and co-workers.

Test	MDI	TDI
Biodegradation (Inherent) % in 28 days	None	None
Bacteria Toxicity (E. Coli) mg/l, 24 h	EC 50 > 100	EC 50 > 100
Daphnia Reproduction (Daphnia magna) mg/l, 24 h	no negative effects at highest concentration (TDI – 0.5, MDI – 10)	
Daphnia Toxicity (Daphnia magna) mg/l, 24 h	EC 50 ≥ 1000	EC 50 ~ 750
Fish Toxicity (Zebra fish) mg/l, 96 h	LC 0 > 1000	LC 0 > 100 LC 100 ≥ 250

medium to form insoluble products. OECD Guidelines do not define the mode of addition of such materials. Under different stirring conditions the physical form and the chemical composition of the reaction products will differ. In that respect it is interesting to note the comment of Curtis and co-workers [36] who found TDI hazardous to freshwater minnows (but not to saltwater shrimp): "The TDI appeared to be toxic to fathead minnows only in unreacted form, since all mortalities occurred during the first twelve hours of test. A concurrent decrease in pH was observed as a result of carbon dioxide formation." It is also possible that toxic effects could have resulted from the associated formation of carbon dioxide.

CONCLUSIONS

This paper suggests that the overall level of environmental pollution from TDI and MDI is very low. Emission levels are low and spillages of MDI or TDI are usually localized, and the diisocyanates very largely converted to materials which are chemically and biologically inert. There is, however, scope for further reductions of emissions or spillages, especially by those users who do not observe rigorous procedures for handling TDI and MDI.

When viewed in their entirety the investigations cited above provide an insight into the probable effects of MDI and TDI in the environment. The evidence indicates that the ecological impact is likely to be slight, and reversible. However, it is recognized that there are limitations to the reported studies of environmental effects. There are many difficulties inherent in the extrapolation from model systems to actual cases; also there are limitations to analytical techniques. Accordingly, the III continues its researches in this field in the interests of man and the environment.

ACKNOWLEDGEMENT

The author would like to thank colleagues in III Member Companies for their comments and suggestions, many of which have been incorporated into this text.

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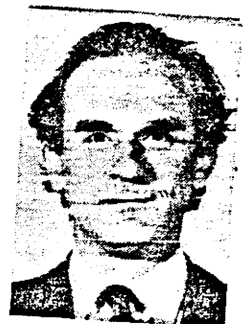
BIOGRAPHY

David S. Gilbert



Having graduated in industrial chemistry, David Gilbert undertook research studies of the kinetics of organic chemical reactions, notably using radiochemical techniques to follow symmetrical exchange reactions. Most of his career has been in polyurethanes, working with ICI on elastomers, flexible foams and rigid foams. In 1982 he established the consultancy David Gilbert Associates and now works exclusively for the III.

M A T E R I A L   S A F E T Y   D A T A   S H E E T

Dow Chemical U.S.A.*   Midland, MI 48674   Emergency Phone: 517-636-4400

Product Code: 92097   Page: 1

PRODUCT NAME: VORANATE (R) T-80 TYPE I TOLUENE DIISOCYANATE

Effective Date: 10/06/88   Date Printed: 10/07/88   MSDS:000609

1. INGREDIENTS: (% w/w, unless otherwise noted)

Toluene-2,4-diisocyanate (TDI)	CAS# 000584-84-9	80%
Toluene-2,6-diisocyanate	CAS# 000091-08-7	20%

This document is prepared pursuant to the OSHA Hazard

Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: 250C (482F)
VAP PRESS: 0.01 mmHg @ 20C
VAP DENSITY: 6.0
SOL. IN WATER: Insoluble
SP. GRAVITY: 1.22 @ 25/15.5C
APPEARANCE: Water white to pale yellow liquid.
ODOR: Sharp pungent odor.

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: 127C (260F)
METHOD USED: PMCC, ASTM D-93

FLAMMABLE LIMITS
LFL: Not determined
UFL: Not determined

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, or foam. If water is used, it should be in very large quantity. The reaction between water and hot isocyanate may be vigorous.

FIRE & EXPLOSION HAZARDS: Down-wind personnel must be evacuated.

(Continued on Page 2)
(R) Indicates a Trademark of The Dow Chemical Company

* An Operating Unit of The Dow Chemical Company

3. FIRE AND EXPLOSION HAZARD DATA: (CONTINUED)

Do not reseal contaminated containers since pressure build-up may cause rupture. Fire point: 146C (295F).

FIRE-FIGHTING EQUIPMENT: People who are fighting isocyanate fires must be protected against nitrogen oxide fumes and isocyanate vapors by wearing positive pressure self-contained breathing apparatus and full protective clothing.

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Stable when stored under recommended storage conditions. Store in a dry place at temperatures between 18-41C (65-105F).

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Water, acid, base, alcohols, metal compounds, surface active materials. Avoid water as it reacts to form heat, CO_2 and insoluble urea. The combined effect of the CO_2 and heat can produce enough pressure to rupture a closed container.

HAZARDOUS DECOMPOSITION PRODUCTS: Isocyanate vapor and mist, carbon dioxide, carbon monoxide, nitrogen oxides and traces of hydrogen cyanide.

HAZARDOUS POLYMERIZATION: May occur with incompatible reactants, especially strong bases, water or temperatures over 41C (105F).

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS:

Evacuate and ventilate spill area, dike spill to prevent entry into water system, wear full protective equipment including respiratory equipment during clean up.

Major spill: Call Dow Chemical U.S.A. (409) 238-2112. If

(Continued on Page 3)

5. ENVIRONMENTAL AND DISPOSAL INFORMATION: (CONTINUED)

transportation spill involved call CHEMTREC (800) 424-9300. If temporary control of isocyanate vapor is required a blanket of protein foam (available at most fire departments) may be placed over the spill. Large quantities may be pumped into closed but not sealed containers for disposal.

Minor spill: Absorb the isocyanate with sawdust or other absorbent and shovel into open top containers. Do not make pressure tight. Transport to a well-ventilated area (outside) and treat with neutralizing solution consisting of a mixture of water and 3-8% concentrated ammonium hydroxide or 5-10% sodium carbonate. Add about 10 parts of neutralizer per part of isocyanate with mixing. Allow to stand for 48 hours letting evolved carbon dioxide to escape.

Clean-up: Decontaminate floor using water/ammonia solution with 1-2% added detergent letting stand over affected area for at least 10 minutes. Cover mops and brooms used for this with plastic and dispose properly (often by incineration).

DISPOSAL METHOD: Follow all federal, state and local regulations. Liquids are usually incinerated in a proper facility. Solids are usually also incinerated or landfilled. Empty drums should be filled with water. Let drum stand unsealed for 48 hours. Before disposal drums should be drained, triple rinsed, and holed to prevent reuse. Dispose of drain and rinse fluid according to federal, state and local laws and regulations. The most commonly accepted method is in an approved wastewater treatment facility. Drums should be disposed of in accordance with federal, state and local laws and regulations. Commonly accepted methods for disposal of plastic drums are disposal in an approved landfill after shredding or incineration in an approved industrial incinerator or other appropriate incinerator facility. Steel drums are commonly disposed in an approved landfill after crushing or in accordance with other approved procedures.

(Continued on Page 4)

6. HEALTH HAZARD DATA:

EYE: May cause pain, severe eye irritation and moderate corneal injury. Vapors may irritate eyes.

SKIN CONTACT: Prolonged or repeated exposure may cause severe irritation, even a burn. Skin contact may result in allergic reaction even though it is not expected to result in absorption of amounts sufficient to cause other adverse effects.

SKIN ABSORPTION: The LD50 for skin absorption in rabbits is >9400 mg/kg.

INGESTION: Single dose oral toxicity is low. The oral LD50 for rats is 5800 mg/kg. Ingestion may cause gastrointestinal irritation or ulceration.

INHALATION: Excessive vapor concentrations are attainable and could be hazardous on single exposure. Single and repeated excessive exposure may cause severe irritation to upper respiratory tract and lungs (choking sensation, chest tightness), respiratory sensitization, decreased ventilatory capacity, liver effects, cholinesterase depression, gastro-intestinal distress and/or neurologic disorders. The 4-hour LC50 for TDI for rats is 13.9 ppm.

SYSTEMIC & OTHER EFFECTS: Based on available data, repeated exposures are not anticipated to cause any additional significant adverse effects. For hazard communication purposes under OSHA standard 29 CFR Part 1910.1200, this chemical is listed as a potential carcinogen by Nat'l. Tox. Program and IARC. An oral study in which high doses of TDI were reported to cause cancer in animals has been found to contain numerous deficiencies which compromise the validity of the study. TDI did not cause cancer in laboratory animals exposed by inhalation, the most likely route of exposure. Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic effects to the mother. Results of in vitro ("test tube") mutagenicity

(Continued on Page 5)

6. HEALTH HAZARD DATA: (CONTINUED)

tests have been inconclusive.

7. FIRST AID:

EYES: Irrigate with flowing water immediately and continuously for 15 minutes. Consult medical personnel.

SKIN: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician if irritation persists. Wash clothing before reuse. Destroy contaminated shoes.

INGESTION: Do not induce vomiting. Call a physician and/or transport to emergency facility immediately.

INHALATION: Remove to fresh air. If not breathing, give mouth-to-mouth resuscitation. If breathing is difficult, give oxygen. Call a physician.

NOTE TO PHYSICIAN: May cause tissue destruction leading to stricture. If lavage is performed, suggest endotracheal and/or esophagoscopic control. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient. The manifestations of the respiratory symptoms, including pulmonary edema, resulting from acute exposure may be delayed. May cause respiratory sensitization. Cholinesterase inhibition has been noted

in human exposure but is not of benefit in determining exposure and is not correlated with signs of exposure.

(Continued on Page 6)

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): OSHA PEL is 0.02 ppm as a ceiling limit for toluene 2,4-diisocyanate. ACGIH TLV is 0.005 ppm; 0.02 ppm STEL for toluene 2,4-diisocyanate. Dow Industrial Hygiene Guide is 0.02 ppm as a ceiling limit for toluene diisocyanate.

VENTILATION: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use an approved supplied-air respirator. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved positive-pressure self-contained breathing apparatus.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron, or full-body suit will depend on operation. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse. Safety shower should be located in immediate work area.

EYE PROTECTION: Use chemical goggles. If vapor exposure causes eye irritation, use a full-face, supplied-air respirator. Eye wash fountain should be located in immediate work area.

9. ADDITIONAL INFORMATION:

REGULATORY REQUIREMENTS:

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is

considered, under applicable definitions, to meet the following categories:

(Continued on Page 7)

(R) Indicates a Trademark of The Dow Chemical Company

* An Operating Unit of The Dow Chemical Company

9. ADDITIONAL INFORMATION: (CONTINUED)

An immediate health hazard
A delayed health hazard
A reactive hazard

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Warning properties of this material (irritation of eyes, nose and throat) not adequate to prevent chronic overexposure from inhalation. This material can produce asthmatic sensitization upon either single inhalation exposure to a relatively high concentration or upon repeated inhalation exposure to lower concentrations. Exposures to vapors of heated TDI can be extremely dangerous. (Have TDI neutralizer available for spills.)

MSDS STATUS: Revised Section 3, 5, 6 and 7.

MATERIAL SAFETY DATA SHEET

BASF Corporation Chemicals Division
100 Cherry Hill Road, Parsippany, New Jersey 07054, (201) 316-3000

HMIS: H4 F1 R1

BASF

PRODUCT NUMBER: 585621 LUPRANATE* T80-Type 1

SECTION I

*Registered Trademark

TRADE NAME: LUPRANATE* T80-Type 1

CHEMICAL NAME: Toluene Diisocyanate

SYNONYMS: TDI; Tolylene Diisocyanate

FORMULA: $CH_3C_6H_3(NCO)_2$

CHEMICAL FAMILY: Aromatic Isocyanates

MOL. WGT.: 174.16

SECTION II - INGREDIENTS

COMPONENT	CAS NO.	%	PEL/TLV - SOURCE
LUPRANATE* T80-Type 1 Contains:		100	Not established
2,4 Toluene Diisocyanate	584-84-9	80	0.005 ppm, ACGIH 0.02 ppm STEL, ACGIH 0.02 ppm Ceiling, OSHA
2,6 Toluene Diisocyanate	91-08-7	20	
SARA Title III Sect. 313: Listed. All components are in TSCA inventory.			

SECTION III - PHYSICAL DATA

BOILING/MELTING POINT @760 mm Hg: 484°F/ N/A	pH: N/A
VAPOR PRESSURE mm Hg @20 C: 0.025	Vapor Density (Air=1): 6.0
SPECIFIC GRAVITY OR BULK DENSITY: 1.22	Freezing Point: 51.8-53.6°F
SOLUBILITY IN WATER: Water reacts	

APPEARANCE: Colorless liquid ODOR: Pungent INTENSITY: Strong

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (TEST METHOD): 270°F TAG Open Cup

AUTOIGNITION TEMP: >620°F

FLAMMABILITY LIMITS IN AIR (% BY VOL) LOWER: 0.9% UPPER: 9.5%

EXTINGUISHING MEDIUM	Use water fog, foam or CO2 extinguishing media.
SPECIAL FIREFIGHTING PROCEDURES	Personnel engaged in fighting isocyanate fires must be protected against nitrogen dioxide fumes as well as isocyanate vapors. Firefighters must wear self-contained breathing apparatus and turnout gear.
UNUSUAL FIRE AND EXPLOSION HAZARDS	Avoid water contamination in closed containers or confined areas; carbon dioxide gas is generated.

EMERGENCY TELEPHONE NUMBER

CHEMTREC 800-424-9300 201-316-3000

THIS NUMBER IS AVAILABLE DAYS, NIGHTS, WEEKENDS, AND HOLIDAYS

DP102 12/87

SECTION V - HEALTH DATA

TOXICOLOGICAL TEST DATA:	RESULT:
LUPRANATE* T80-Type 1	
2,4 Toluene Diisocyanate	Severe eye and skin irritant, sensitizer
Rat, Oral LD50	5.8 g/kg.
Mouse, Inhalation LC50	10 ppm/4H

EFFECTS OF OVEREXPOSURE:

The primary routes of exposure to this material are eye or skin contact, and inhalation.
Inhalation of the vapors causes severe irritation to lungs, and pulmonary edema can occur after a serious vapor exposure. Liquid contact causes serious skin and eye burns. Pulmonary sensitization can occur in some individuals leading to asthma-type spasms of the bronchial tubes and difficulty in breathing. Preclude from exposure those individuals having a history of respiratory illness, asthmatic conditions, eye damage or TDI sensitization. Recent studies indicate that overexposure may be associated with chronic lung impairment. In a National Toxicology Program (NTP) study, TDI was carcinogenic when given orally to rats and mice at maximum tolerated doses. TDI was not carcinogenic to rats in a two-year inhalation study. Based on the results of the oral study, TDI was included in the NTP Annual Report on Carcinogens.

FIRST AID PROCEDURES:

Existing medical conditions aggravated by exposure to this material:
Pulmonary disorders.

Eyes-Immediately wash eyes with running water for 15 minutes. Get immediate medical attention.
Skin-Wash affected areas with water while removing contaminated clothing. Get immediate medical attention. Launder contaminated clothing before reuse.
Ingestion-If swallowed, DO NOT INDUCE VOMITING. Dilute with water or milk and get immediate medical attention. Never give fluids or induce vomiting if the victim is unconscious or having convulsions.
Inhalation-Move to fresh air. Aid in breathing, if necessary, and get immediate medical attention.

SECTION VI - REACTIVITY DATA

STABILITY: Stable.
CONDITIONS TO AVOID: Avoid temperatures >40°C for extended periods of time.

CHEMICAL INCOMPATIBILITY: Water, basic compounds, alcohols, acids, amines.

HAZARDOUS DECOMPOSITION PRODUCTS: TDI vapors, NOx, CO and HCN.

HAZARDOUS POLYMERIZATION: May occur.
CONDITIONS TO AVOID: Avoid contamination with moisture and other products that react with isocyanates.

CORROSIVE TO METAL: No | **OXIDIZER:** No

SECTION VII - SPECIAL PROTECTION

RESPIRATORY PROTECTION:
NIOSH/MSHA approved respiratory equipment for transfer operations or escape. Self-contained breathing apparatus if the P.E.L. is exceeded, or in confined areas or if a leak occurs.

EYE PROTECTION: Wear fitted goggles or face shield and safety glasses.

PROTECTIVE CLOTHING: Rubber gloves, coveralls, boots and rubber apron which must be cleaned after each use. Hardhat for head protection.

VENTILATION: Use local exhaust wherever vapors are generated.

OTHER: Maintain work area below P.E.L. Vented vapors should be scrubbed through carbon filters or other similarly effective medias.

PRODUCT NUMBER: 585621 LUPRANATE* T80-Type 1

SECTION VIII - ENVIRONMENTAL DATA

ENVIRONMENTAL TOXICITY DATA:

--- Aquatic toxicity rating: TLm 96: 10 ppm - 1 ppm.

SPILL AND LEAK PROCEDURES:

LUPRANATE* T80 is a RCRA-regulated product. Wear protective clothing, evacuate all not involved in the cleanup. For minor spills, absorb with absorbent and containerize into open top drums. Decontaminate spill area with a mixture of 90% water, 8% concentrated ammonia and 2% detergent.

HAZARDOUS SUBSTANCE SUPERFUND: Yes RQ (lbs): 100

WASTE DISPOSAL METHOD:

Dispose of waste in a RCRA-permitted facility.
Incinerate or landfill in a RCRA-permitted facility.

HAZARDOUS WASTE 40CFR261: Yes HAZARDOUS WASTE NUMBER: U 223

CONTAINER DISPOSAL:

Containers should be neutralized with liquid decontaminant. Empty containers, containing less than 1" of residue, may be landfilled. If containers are not empty, they must be disposed as a hazardous waste in a RCRA-licensed facility.

SECTION IX - SHIPPING DATA

D.O.T. PROPER SHIPPING NAME (49CFR172.101-102)

Toluene Diisocyanate

HAZARDOUS SUBSTANCE (49CFR CERCLA LIST)

Yes

REPORTABLE QUANTITY (RQ) 100 lb

D.O.T. HAZARD CLASSIFICATION (CFR172.101-102)

PRIMARY

Poison B

SECONDARY

D.O.T. LABELS REQUIRED (49CFR172.101-102)

Poison

D.O.T. PLACARDS REQUIRED (CFR172.504)

BULK ONLY
Poison-2078

POISON CONSTITUENT (49CFR172.203(K))

TDI

BILL OF LADING DESCRIPTION

Toluene Diisocyanate-Poison B-UN 2078 RQ 100 lbs.
*** Placarded: POISON ***

CC NO. 190

UN/NA CODE 2078

DATE PREPARED: 4 / 17 / 86

UPDATED: 5 / 18 / 88

WHILE BASF CORPORATION BELIEVES THE DATA SET FORTH HEREIN ARE ACCURATE AS OF THE DATE HEREOF, BASF CORPORATION MAKES NO WARRANTY WITH RESPECT THERETO AND EXPRESSLY DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. SUCH DATA ARE OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION.

SECTION X - PRODUCT LABEL

LUPRANATE* T80-Type 1

DANGER: POISON
HARMFUL IF INHALED.
CONTACT WITH EYES AND SKIN RESULTS IN SERIOUS BURNS. INHALATION OF VAPORS CAUSES SEVERE IRRITATION TO LUNGS. PULMONARY EDEMA MAY OCCUR. PULMONARY SENSITIZATION CAN OCCUR IN SOME INDIVIDUALS, LEADING TO ASTHMA-TYPE SPASMS OF THE BRONCHIAL TUBES AND DIFFICULTY IN BREATHING. INDIVIDUALS WITH A HISTORY OF RESPIRATORY ILLNESS, ASTHMATIC CONDITIONS, EYE DAMAGE OR TDI SENSITIZATION SHOULD NOT BE EXPOSED TO THIS PRODUCT.
IN AN NTP STUDY, TDI WAS CARCINOGENIC TO RODENTS GIVEN HIGH ORAL DOSES AND IS INCLUDED IN THE NTP ANNUAL REPORT ON CARCINOGENS. TDI WAS NOT CARCINOGENIC TO RATS IN A TWO-YEAR INHALATION STUDY.

Use with local exhaust. Wear an approved respirator or self-contained breathing apparatus, fitted goggles or face shield and safety glasses, rubber gloves, coveralls, boots, apron and other protective clothing as necessary to prevent contact.

FIRST AID:
Eyes-Immediately wash eyes with running water for 15 minutes. Get immediate medical attention.
Skin-Wash affected areas with water while removing contaminated clothing. Get immediate medical attention. Launder contaminated clothing before reuse.
Ingestion-If swallowed, DO NOT INDUCE VOMITING. Dilute with water or milk and get immediate medical attention. Never give fluids or induce vomiting if the victim is unconscious or having convulsions.
Inhalation-Move to fresh air. Aid in breathing, if necessary, and get immediate medical attention.

HANDLING AND STORAGE: Keep containers closed and store in a well-ventilated place. Outage of container should be filled with dry inert gas at atmospheric pressure to avoid reaction with moisture. Contamination by moisture or basic compounds can cause dangerous pressure buildup in closed container. Store Store above 60 F to prevent freezing and isomer separation. If solidified, do not exceed 95 F while thawing to prevent discoloration. Mix before using.

IN CASE OF SPILLS OR LEAKS: Material is a RCRA-regulated product. Spills should be contained, absorbed and placed in suitable containers for disposal in a RCRA-licensed facility.

IN CASE OF FIRE: Use water fog, foam or CO2 extinguishing media. Firefighters should be equipped with self-contained breathing apparatus and turnout gear for protection against TDI vapors and toxic decomposition products.

EMPTY CONTAINERS: All labeled precautions must be observed when handling, storing and transporting empty containers due to product residues. Do not reuse this container unless it is professionally cleaned and reconditioned.

DISPOSAL: Spilled material, unused contents and empty containers must be disposed of in accordance with local, state and federal regulations. Refer to our Material Safety Data Sheet for specific disposal instructions.

IN CASE OF CHEMICAL EMERGENCY: Call CHEMTREC day or night for assistance and information concerning spilled material, fire, exposure and other chemical accidents 800-424-9300.

ATTENTION: This product is sold solely for use by industrial institutions. Refer to our Technical Bulletin and Material Safety Data Sheet regarding safety, usage, applications, hazards, procedures and disposal of this product. Consult your supervisor for additional information.

FOR INDUSTRY USE ONLY.
CAS No.: 584-84-9; 91-08-7.
Proper Shipping Name: Toluene Diisocyanate, Poison B - UN 2078 RQ
Made in USA.
Polymers
0488

Stone

MATERIAL SAFETY DATA SHEET

2290

ICI Polyurethanes Group
Wilmington, Delaware 19897
Phone (302) 575-3000 (24 Hours)

Rev.: E
Date: 08/04/87

SECTION 1 NAME & HAZARD SUMMARY

Material name:
RUBINATE TDI

Hazard summary (as defined by OSHA Hazard Communication Standard, 29 CFR 1910.1200):
Physical hazards: Unstable
Health hazards: Inhalation (TLV), irritant (skin, mucous membranes, skin sensitizer), corrosive (eye), harmful (respiratory sensitizer, lung injury)

Read the entire MSDS for a more thorough evaluation of the hazards.

SECTION 2 INGREDIENTS

	%	TLV (ACGIH)
Toluene diisocyanate, 2,4-isomer (CAS 584-84-9)	ca 80	0.005 ppm
Toluene diisocyanate, 2,6-isomer (CAS 91-08-7)	ca 20	Not listed

Ingredients not precisely identified are proprietary or nonhazardous. All ingredients appear on the EPA TSCA Inventory. Values are not product specifications. gt = greater than, lt = less than, ca = approximately

SECTION 3 PHYSICAL DATA

Boiling point: 484°F, 251°C
Vapor pressure (mmHg at 20°C): 0.02
Vapor density (air = 1): 6.0
Solubility in water: Reacts
pH: Not applicable
Specific gravity: 1.22
% Volatile by volume: Negligible
Appearance and odor: Clear colorless liquid with sharp pungent odor

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

Flash point (and method): 270°F, 132.2°C (open cup)
Autoignition temp.: No data
Flammable limits (STP): 0.9 - 9.5%

Extinguishing media:
Dry chemical, foam, carbon dioxide, halon 1211. If water is used, use very large quantities. The reaction between water and hot isocyanate may be vigorous.

Special fire fighting protective equipment:
Self-contained breathing apparatus with full facepiece and protective clothing.

Unusual fire and explosion hazards:
Water contamination will produce carbon dioxide. Do not reseal contaminated containers as pressure buildup may rupture them.

SECTION 5 REACTIVITY DATA

Stability:
Stable under normal conditions.

Incompatibility (materials to avoid):
This product will react with any materials containing active hydrogens, such as water, alcohol, ammonia, amines, alkalies. The reaction with water is very slow below 50°C but is accelerated at higher temperatures and in the presence of alkalies, tertiary amines, and metal compounds. Some reactions can be violent.

Hazardous decomposition products:
Combustion products: Carbon dioxide, carbon monoxide, nitrogen oxides, traces of hydrogen cyanide.

Hazardous polymerization:
May occur. High temperatures and the presence of alkalies, tertiary amines, and metal compounds will accelerate polymerization. The heat from the polymerization reaction can potentially lead to ignition. Possible evolution of carbon dioxide gas may rupture closed containers.

SECTION 6 HEALTH HAZARD ASSESSMENT

General:
The health hazard assessment is based on information from the scientific literature.

Ingestion:
The acute oral LD_{50} in rat is reported to be 5.8 g/kg. Relative to other materials, a single dose of this product is practically nontoxic by ingestion. Irritation of the mouth, pharynx, esophagus and stomach can develop following ingestion.

Eye contact:
This material is reported to induce chemical burns in rabbit eye studies; a similar degree of eye injury will probably develop after contact with human eyes.

Skin contact:
This material is reported to be severely irritating in rabbit dermal irritation studies and will probably irritate human skin. Dermatitis and skin sensitization can develop after repeated and/or prolonged contact with human skin.

Skin absorption:
The acute dermal LD_{50} in rabbit is reported to be above 16 g/kg. Systemically toxic concentrations will probably not be absorbed through human skin.

Inhalation:
TDI vapors are easily generated and are lethal to rats via inhalation at concentrations below 10 ppm. A no effect level for rats of about 0.1 ppm was determined from a subacute study. This and other data indicate the vapors and aerosols of TDI are highly toxic relative to the vapors of other compounds. Vapors and aerosols of TDI strongly irritate the upper and lower respiratory tract. Human experience indicates that TDI will induce an asthma-like respiratory sensitization in some individuals. If applications which involve spraying (e.g. aerosols and mists) or if elevated temperatures are used, even higher vapor concentrations may result and introduce a greater degree of risk of inhalation injury.

SECTION 6 HEALTH HAZARD ASSESSMENT (continued)

Inhalation (continued):

Rat and mouse toxicity and carcinogenicity studies were conducted with two years of inhalation exposure to vapors of TDI at concentrations of 0.05 and 0.15 ppm. No indication of carcinogenic effect was observed. However, mice exposed to 0.15 ppm for two years showed reduced weight gain and signs of irritation in the upper and lower respiratory tract. No other effect of toxicological significance was observed.

Other effects of overexposure:

Vapors and aerosols can irritate eyes, skin, and upper respiratory tract resulting in sinusitis, bronchitis, and wheezing; irritation to the lower respiratory tract (pulmonary edema) can also be induced. Allergic respiratory responses can occur in sensitized individuals. There are two studies which allege that workers exposed to TDI at or near the current TLV have experienced impaired ventilatory capacities. These findings have not been independently substantiated.

The National Toxicology Program (NTP) 4th Annual Report on Carcinogens (1985) lists TDI as a substance that may reasonably be anticipated to be a carcinogen based on a NTP Technical Report. In the cited study, laboratory animals gavaged TDI in corn oil developed cancer. In our view, the inhalation study is of more potential biological relevance to man.

First aid procedures:

Skin: Remove contaminated clothing and footwear. Wash material off the skin with plenty of soap and water. Get medical attention. Wash contaminated clothing and decontaminate footwear before reuse.

Eyes: Immediately flush with plenty of water for at least 15 minutes and have eyes examined and treated by medical personnel.

Ingestion: DO NOT induce vomiting. Give one or two glasses of water to drink and refer victim to medical personnel. (Never give anything by mouth to an unconscious person.)

Inhalation: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is labored, give oxygen. Consult medical personnel.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage following ingestion.

SECTION 7 SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled:

Wear skin, eye and respiratory protection during cleanup. Soak up liquid with absorbent and shovel into waste container. Cover container, but do not seal, and remove from work area. Prepare a decontamination solution of 0.2-0.5% liquid detergent and 3-8% concentrated ammonium hydroxide in water (5-10% sodium carbonate may be used in place of the ammonium hydroxide solution). In very cold situations, a mixture of isopropanol and perchloroethylene can be used. Treat the spill area with decontamination solution, using about 10 parts of the solution for each part of the spill, and allow it to react for at least 10 minutes. Carbon dioxide will be evolved, leaving insoluble polyureas.

For major transportation spills, call Chemtrec (Chemical Transportation Emergency Center), (800) 424-9300.

SECTION 7 SPILL OR LEAK PROCEDURES (continued)

Disposal method:

Slowly stir the isocyanate into the decontamination solution described above, using 10 parts of solution for each part of isocyanate. Let stand for 48 hours, allowing the evolved carbon dioxide to vent away. Neutralize the waste. If all the TDI material has been decontaminated, then neither the liquid nor the solid portions of waste are hazardous wastes under RCRA 40 CFR 261.

Container disposal:

Drums must be decontaminated in properly ventilated areas by personnel protected from the inhalation hazards of isocyanate vapors.

1. Fill drum with decontamination solution described above, making sure all contaminated areas are in contact with the decontamination solution.
2. Leave drum soaking unsealed for 48 hours.
3. Drain liquid decontaminant into storage container. Decontamination solution can be used several times. Neutralize spirit decontamination solution and dispose of in a sewer serviced by a wastewater treatment facility. Triple rinse empty container and pour rinse solution into drain or sewer serviced by a wastewater treatment facility.
4. Puncture or otherwise destroy container before disposal.

SECTION 8 SPECIAL PROTECTION INFORMATION

TLV® or suggested control value:

The ACGIH TLV is 0.005 ppm, 0.02 ppm ceiling. NIOSH recommends 0.005 ppm TWA and 0.02 ppm STEL (Short Term Exposure Limit). The OSHA PEL is 0.02 ppm.

The control values do not apply to sensitized individuals. Sensitized individuals should be removed from further exposure.

Ventilation:

Use local exhaust to keep exposures to a minimum.

Respiratory protection (specify type):

If necessary, use a MSHA-NIOSH approved positive pressure supplied air respirator with a full face piece. For emergencies use a positive pressure self-contained breathing apparatus.

Protective clothing:

Take all precautions to prevent skin contact. Use impervious gloves, arm covers and apron. Additional protection, such as full body suit and boots, may be required depending on conditions.

Eye protection:

Chemical tight goggles and full faceshield.

Other protective equipment:

Eyewash station and safety shower in work area.

SECTION 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

Precautions to be taken in handling or storing:

Prevent skin and eye contact. Observe TLV limitations. Avoid breathing vapors or aerosols. A sensitized individual should not be exposed to the product which caused the sensitization. Store in tightly sealed containers to protect from atmospheric moisture. Provide a dry nitrogen pad if stored in bulk. Store at a temperature of 60-100°F.

General Foam
Corporation
® TRADEMARK OF GENERAL FOAM CORPORATION
Valmont Industrial Park
West Hazleton, Pennsylvania 18201
(717) 455-4931

Document Processing Center
Office of Toxic Substances, TS-790
U.S. Environmental Protection Agency
401 M Street, SW
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Attn: CAIR Reporting Office

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